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CALENDAR

OF THE

SCHOOL OF MINING

A COLLEGE OF APPLIED SCIENCE
(Affiliated to Queen's University)

KINGSTON, ONTARIO

TWENTY-FIRST SESSION
1913-1914

KINGSTON:
PRINTED AT THE BRITISH WHIG OFFICE
1913

1913/14

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OFFICERS OF ADMINISTRATION.

VISITOR.

HON. J. M. GIBSONLIEUTENANT-GOVERNOR OF ONTARIO

CHAIRMAN OF THE BOARD OF GOVERNORS.....D. M. McINTYRE, B.A., K.C.

VICE-CHAIRMANR. CRAWFORD, B.A.

BOARD OF GOVERNORS.

Retire 1913.

T. B. CALDWELL..... Ottawa

JAS. DOUGLAS, B.A., LL.D..... New York

A. P. KNIGHT, M.A., M.D.....Kingston

R. W. LEONARD, C.E. St. Catharines

†J. DONNELLY, M.E. Kingston

‡C. A. MACPHERSON Kingston

Retire 1914.

HON. WM. HARTY Kingston

D. M. McINTYRE, B.A., K.C..... Kingston

J. McKELVEY Kingston

W. F. NICKLE, B.A., M.P..... Kingston

†R. W. BROCK, M.A. Ottawa

‡W. G. MILLER, B.A., LL.D..... Toronto

*ALD. D. A. GIVENS Kingston

Retire 1915.

J. B. CARRUTHERS Kingston

N. F. DUPUIS, M.A., LL.D..... Kingston

MILTON L. HERSEY, M.Sc., LL.D..... Montreal

JAMES SWIFT Kingston

†A. LONGWELL, B.Sc. Toronto

‡T. W. NASH Kingston

Retire 1916.

B. W. ROBERTSON Kingston

H. A. CALVIN Kingston

R. CRAWFORD, B.A. Kingston

SIR SANDFORD FLEMING, K.C.M.G..... Ottawa

†A. SHORTT, LL.D. C.M.G..... Ottawa

H. W. RICHARDSON Kingston

Those marked * are appointed by the City Council for one year.

Those marked † are elected by the graduates.

Those marked ‡ are appointed by the Ontario Government.

Those not marked are elected by the shareholders.

OFFICERS OF INSTRUCTION.

FACULTY

WILLIAM L. GOODWIN, B.Sc., D.Sc., F.R.S.C.....	Alice Street.
<i>Professor of Chemistry and Dean of the School of Mining.</i>	
D. H. MARSHALL, M.A., F.R.S.E.	
<i>Emeritus Professor of Physics.</i>	
WILLIAM NICOL, M.A.....	203 Albert Street.
<i>Professor of Mineralogy.</i>	
L. W. GILL, M.Sc.....	Portsmouth.
<i>Professor of Electrical Engineering.</i>	
S. F. KIRKPATRICK, M.Sc.....	84 Gore Street.
<i>Professor of Metallurgy.</i>	
J. C. GWILLIM, B.Sc.....	173 Union Street West.
<i>Professor of Mining Engineering.</i>	
A. K. KIRKPATRICK	68 Johnston Street.
<i>Professor of Civil Engineering.</i>	
ALEXANDER MACPHAIL, B.Sc.....	50 Clergy Street.
<i>Professor of General Engineering.</i>	
A. L. CLARK, B.Sc., Ph.D.....	200 Albert Street.
<i>Professor of Physics.</i>	
F. O. WILLHOFT, M.E., M.A.....	93 Wellington Street.
<i>Professor of Mechanical Engineering.</i>	
M. B. BAKER, B.A., B.Sc., F.G.S.A.....	20 Stuart Street.
<i>Professor of Geology.</i>	
H. T. KALMUS, B.Sc., Ph.D.....	70 Barrie Street.
<i>Professor of Electro-Chemical and Metallurgical Research.</i>	
W. O. WALKER, M.A.....	402 Johnston Street.
<i>Associate Professor of Chemistry.</i>	
JOHN WADDELL B.A., D.Sc., Ph.D.....	132 Earl Street.
<i>Assistant Professor of Chemistry.</i>	
W. C. BAKER, M.A.....	110 Victoria Street.
<i>Assistant Professor of Physics.</i>	
LEO F. GUTTMAN, A.C.G.I., Ph.D., F.I.C.....	46 Earl Street.
<i>Assistant Professor of Chemsitry.</i>	
E. W. HENDERSON, B.Sc.....	229 Albert Street.
<i>Assistant Professor of Electrical Engineering.</i>	
LINDSAY MALCOLM, M.A., B.Sc., O.L.S., D.L.S....	333 Earl Street.
<i>Assistant Professor of Civil Engineering.</i>	
W. D. BONNER, M.A., Ph.D.....	138 Nelson Street.
<i>Assistant Professor of Chemistry.</i>	

- JESSE E. HYDE, M.A.208 Albert Street.
Assistant Professor of Geology.
- J. M. ADAMS, M.A., Ph.D.
Assistant Professor of Physics.
- D. S. ELLIS, M.A., B.Sc.....127 Bagot Street.
Assistant Professor in Applied Mathematics.
- O. G. WELLTON, M.E.....34 Wellington Street.
Lecturer in Mechanical Engineering.
- C. W. DRURY, B.Sc., A.M.....Nicol Hall.
Lecturer in Mining and Metallurgy.
- J. A. WORKMAN, M.A.....207 William Street.
Lecturer in Mathematics.
- V. E. POUND, M.A.....Ontario Hall.
Lecturer in Physics.
- J. A. McRAE, M.A., A.I.C.....Gordon Hall.
Lecturer in Chemistry.
- C. B. COVINGTON, B.E.....58 William Street.
Lecturer in Drawing.
- C. W. BURROUGHS, B.Sc.,
Lecturer in Mechanical and Electrical Engineering.
- F. ETHERINGTON, L.R.C.P. and S. (Edin.).....218 Albert Street.
Medical Adviser.
- JAMES G. BEWS,
Physical Director.
- J. H. MOXLEY,
Assistant Physical Director.
- J. WADDELL, B.A., D.Sc., Ph.D.
Librarian.
- G. Y. CHOWN, B.A.....Union Street West.
Secretary-Treasurer.

RESEARCH ASSOCIATES.

- C. HARPER, B.A.140 Union Street.
- H. L. SAVELL, B.Sc.....100 Victoria Street.

ASSISTANTS AND FELLOWS.

- N. B. DAVIS, B.Sc.
Assistant in Mineralogy.
- E. S. BISHOP, M.A., B.Sc.
Milton Hersey Fellow in Chemistry.

DEMONSTRATORS.

PHYSICS:

C. S. ALLIN	J. W. CAMPBELL	J. A. BENNIE
J. E. FRASER	H. L. HOWSON	W. H. ADAMSON
C. B. BATE	A. E. THOMPSON	

CHEMISTRY:

J. D. DETWEILER, B.A.	A. F. G. CADENHEAD	J. A. TUTTLE, M.A.
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DOUGLAS TUTORS.

BAKER, H. S.	HARKNESS H. W.
BATE, C. B.	JEMMETT, D. M.
BICK, A.	DAWSON, W. G.
BUCHANAN, W. C.	MATTHEWS, H. E.
BURNHAM, W.	McRAE, A. E.
CALVIN, R. M.	McKENZIE, C. S.
DALY, F. G.	MELROSE, T. M.
DAWSON, W. L.	RAITT, G. H.
DUNLOP, H. J.	STEWART, N. G.
EARNSHAW, P.	VAN PATTEN, H.
FARRELL, J. W. D.	WOOD, F. M., M.A.

PROFESSORS OF QUEEN'S UNIVERSITY WHOSE CLASSES ARE ATTENDED BY STUDENTS OF THE SCHOOL OF MINING.

<i>English</i>	J. F. MACDONALD, M.A.
<i>Botany</i>	W. T. MACCLEMENT, M.A., D.Sc.
<i>Animal Biology</i>	A. P. KNIGHT, M.A., M.D.
<i>German</i>	JOHN MACGILLIVRAY, Ph.D.
<i>French</i>	P. G. C. CAMPBELL, M.A.
<i>Mathematics</i>	J. MATHESON, M.A.
<i>Economics</i>	{ O. D. SKELTON, M.A., Ph.D.
	{ W. W. SWANSON, M.A., Ph.D.

CALENDAR.

1913.

- June 12—Honour Matriculation examinations begin at University and every Collegiate Institute and High School in Ontario.
June 13—Junior Matriculation examinations begin.
Sept. 1—Applications, stating subjects and accompanied by fee, for Supplemental Pass examinations to be made to the Registrar.
Sept. 1—Shop Work for Courses F and G begins.
Sept. 18—Supplemental Pass Examinations begin.
Oct. 1—Classes open (1st term), at 8 a.m.
Oct. 3—Last day for registration without extra fee.
Oct. 16—University Day.
Oct. 31—Last day for registration.
Dec. 19—Christmas Holidays begin at 5 p.m.

1914.

- Jan. 5—Classes re-open (2nd term) at 8 a.m.
Feb. 25—Holiday (Ash Wednesday).
April 1—Classes close at 5 p.m.
April 6—Examinations begin.
April 10—Good Friday.
April 27—Meeting of Faculty to consider reports of examiners.
April 28—Engineering Field Work I begins.
April 29—Convocation for distributing prizes, announcing honours and conferring degrees.

JUNIOR MATRICULATION EXAMINATIONS.

SEPTEMBER, 1913.

9 a.m.

1.30 p.m.

Monday,	8th Sept.—Algebra.	English Composition.
Tuesday,	9th Sept.—Geometry.	English Literature.
Wednesday,	10th Sept.—Experimental Science. (Physics)	History (B. and C.)
Thursday,	11th Sept.—Exp. Science (Chem.)	History (Anc.)
Friday,	12th Sept.—Latin Auth., Vir., &c.	Latin Comp., Caesar, &c.
Monday,	15th Sept.—French Authors.	French Composition.
Tuesday,	16th Sept.—German Authors.	German Composition.
Wednesday,	17th Sept. Greek Authors.	Greek Composition.
Thursday,	18th Sept.—Arithmetic.	English Grammar.

NOTE:—At all examinations in Mathematics, candidates should provide themselves with a ruler (showing millimetres and sixteenths of an inch), a pair of compasses and a protractor.

ANNOUNCEMENT.

The School of Mining is a branch of the *School of Mining and Agriculture*, incorporated in 1893 by Act of the Legislature of Ontario. It is affiliated to Queen's University which confers all degrees.

While originally a Mining School it has been expanded to include courses of study for degrees in mining and metallurgy, in civil, mechanical, electrical and chemical engineering, in analytical chemistry and assaying, and in geology and mineralogy. The objects of the institution are to provide thorough instruction, both theoretical and practical, in these and other branches of applied science, and to adapt courses of study and methods of presentation to the conditions prevailing in Canada, so as to secure as nearly as may be a maximum usefulness to the country.

Kingston is well situated as the seat of a college of engineering and applied science. Geology and mineralogy, two of the fundamental subjects of a mining engineer's education and also important in other scientific professions, are studied to best advantage where the minerals can be seen as they lie in nature, and where geological formations can be examined *in situ*. In a few hours a class of students can be taken by carriage to a region so rich in mineral species that about forty different kinds have been secured in an afternoon. There are several geological formations out-cropping within easy walking distance of the city. If to this be added the accessibility by a short railway journey, of mines in operation, the opportunities for instructive demonstrations to classes in mineralogy, geology, and mining are very numerous. The metallurgical works at Deloro, eighty miles from Kingston, are also open to our students. It is thus possible to give to the study of mineralogy, geology, mining and metallurgy, that practical turn which not only adds interest to the college course, but shortens the period between graduation and the attainment of proficiency and confidence in professional work.

The variety of topographical features in the surrounding country affords the best of material for practice in all branches of surveying, including railway, topographic, hydrographic and land surveying. The main line of the Grand Trunk passes through the city limits and Kingston is a terminus of branches of the Canadian

Pacific and Canadian Northern Railways. The Canadian Locomotive Works, which are the largest locomotive shops in Ontario, are within ten minutes walk of the School of Mining, and are open to our students for study and for assisting in engine testing and similar work. Kingston has two Dry Docks, one of which, the large Dominion Government Dock, is now under lease to the Kingston Ship Building Co., in whose yards steel construction can be practically studied. The locks of the Rideau Canal can be visited at Kingston Mills, six miles from the heart of the city. There are also several water powers within easy distance, some of which are as yet awaiting development, while others can be seen in use at Gananoque (18 miles distant), at Trenton (60 miles distant), and at other points. Students of civil, mechanical and electrical engineering thus have easy access to practical illustrations of their professional studies.

EXPENSES.

The following statement of expenses for a session is made from information obtained from students who have kept an account of their expenditures. Personal expenses are not included in the estimates. The average expense for class fees is included in this estimate:

Class and other fees	\$100.00 to \$100.00
Board, lodging and washing	120.00 to 150.00
Books and Stationery	15.00 to 25.00
Incidentals	9.00 to 14.00
Excursions (geology, mineralogy and mining).....	8.00 to 12.00
	<hr/>
	\$252.00 to \$301.00

The estimates are based on board, etc., at from \$4.00 to \$5.00 per week, at which rates good board can be had in Kingston.

The fee for graduation is not included in the estimate.

HOSPITAL PRIVILEGES.

The Governors of the Kingston General Hospital agree to give those students who take out Hospital Tickets (cost \$2) all the advantages of a private room, including room, board, attendance of nurses in training, and ordinary medicines, when requiring medical or surgical treatment, from October 1st to May 1st. These benefits are conditional on 250 students taking out tickets by November 1st.

REQUIREMENTS FOR ADMISSION.

I. Every regular student is required to pass the matriculation examination or an equivalent thereto before being admitted to examinations leading to a diploma or degree, and must follow one of the courses hereafter mentioned. (See page 26).

II. MATRICULATION—A candidate is admitted as a regular student, if he has:—

(1) Matriculated in any University or Technical College in the British Empire or the United States.

(2) Passed the Normal Entrance or Junior Matriculation Examination of the Department of Education of Ontario, or equivalent examinations in the subjects of English Composition, English Literature, Algebra and Geometry, History (British and Canadian), together with any two of the following: Latin, Greek, French, German, and Experimental Science. The pass standard is forty per cent. of the marks assigned to a paper with an average of sixty per cent., with such modification or exceptions as may be deemed proper in consideration of the total number of marks and the confidential reports of the Principals.

For syllabus of work covered by the examination see pamphlet on Matriculation issued by Queen's University, a copy of which will be sent upon application to the Registrar.

A candidate who has obtained the average of sixty per cent. on all the papers but has failed to obtain forty per cent. in one or two or at most three of these papers may complete Junior Matriculation by passing on these papers at any one subsequent examination.

(3) Passed equivalent examinations or otherwise gained equivalent standing.

Equivalent Examinations are:—

Ontario.....	Junior Leaving.
Prince Edward Island....	Second Class.
Nova Scotia	Grade XI.
New Brunswick.....	Second Class.
Quebec.....	} Academy Grade III. University School AA.
Newfoundland.....	
Manitoba.....	Intermediate (50% required).
Saskatchewan.....	Second Class.
Alberta.....	} Grade VII.
British Columbia.....	
	Intermediate.

United States.—A certificate from any school which is on the list of approved schools of any University or Technical College of recognized standing will be accepted as equivalent to matriculation examinations.

Candidates who offer for matriculation any conditions other than (1) or (2) will forward to the Secretary, for the consideration of the Faculty, their applications accompanied by certificates and information.

III. Students who have already taken, in a University *arts or science faculty* or in a recognized technical or military school, subjects included in a course in the School of Mining will, on entering upon a course for the degree of B.Sc., be admitted to the year for which they are qualified.

IV. A candidate who is actually engaged in a mercantile, industrial, or other occupation may proceed to pass Junior Matriculation under the following conditions:—

(a) He may present himself for one or more subjects at any July or September Examination.

(b) At any such Examination he will receive credit for a subject or subjects on obtaining 40 per cent. in each paper and an aggregate of 60 per cent. of the total marks assigned to such subject or subjects. There are two papers given in each subject.

(c) Matriculation must be completed under these conditions within four consecutive years.

In order to secure credit for the subject or subjects written, a candidate who desires to matriculate under these regulations must, immediately on receipt of his Departmental statement of marks, return the same to the Deputy Minister of Education accompanied by a certificate from his employer to the following effect:—

.....191....
I,.....do hereby certify that.....
was in my employ from.....to.....in the
capacity of.....and that this employment made it
impossible for him to attend the regular day sessions of a secondary
school. My business is that of
located at

Give business address in full

.....
Signature in full

To the Deputy Minister of Education.

V. SUPPLEMENTAL MATRICULATION—The Supplemental Pass Junior Matriculation examination is conducted by the Department of Education for the University Matriculation Board, at the following centres:—

(a) The University of Toronto; Queen's University, Kingston; McMaster University, Toronto; Western University, London.

(b) Any of the following, upon request:—Windsor, Chatham, Sarnia, St. Thomas, London, Woodstock, Brantford, Simcoe, Cayuga, Welland, St. Catharines, Hamilton, Goderich, Stratford, Berlin, Guelph, Walkerton, Owen Sound, Orangeville, Barrie, Whitby, Bowmanville, Cobourg, Lindsay, Peterborough, Belleville, Picton, Napanee, Brockville, Kemptville, Prescott, Morrisburg, Cornwall, Alexandria, Vankleek Hill, Ottawa, Smiths Falls, Renfrew, Bracebridge, North Bay, Sault Ste. Marie, Port Arthur, Haileybury.

(c) Elsewhere in Ontario, upon request, and if approved by the University Matriculation Board.

(d) Elsewhere in Canada, upon request of one of the aforesaid Universities and approval of the Board.

2. Applications to write on the examinations, accompanied by the necessary fee, will be received at the Department of Education as follows:—

(a) Up to September 1st, from those who wish to write at any centre authorized in Ontario.

(b) Up to August 25th, from those who wish to write elsewhere in Ontario.

(c) Up to August 1st, from those who, through one of the aforesaid Universities, make application to write outside of the Province of Ontario.

3. On payment of the required fee with one dollar additional, a candidate who has failed to make application as specified in the foregoing regulation (2) may be admitted to examination at a centre already established, provided the accommodation is adequate and the number of question papers is sufficient.

4. The subjects of the examination, the prescription of work and the standard required shall be the same as for the annual Pass Junior Matriculation examination of the same year.

5. The following are eligible to become candidates at this examination:—

(a) Those who are applicants for the complete Matriculation examination.

(b) Those who are completing this examination under the University requirement in force previous to 1909, which reads as follows:—

“Candidates who have failed in a minority of subjects at a previous examination may present themselves at this examination.”

(c) Those who are completing this examination under the University requirement for 1910, which reads:—

“In 1910 a candidate who has failed to obtain pass standing in not more than three papers may complete Junior Matriculation by passing on these papers at any one subsequent examination.”

(d) Those who are completing this examination under the University requirement for 1911, which reads:—

“A candidate in 1911 who has obtained the average of fifty per cent. on all the papers but has failed to obtain forty per cent. in one or two or at most three of these papers may complete Junior Matriculation by passing on these papers at any one subsequent examination.”

6. Candidates who present themselves under 5 (a) and pass the complete examination for Matriculation in any one year will be granted Departmental certificates of Pass Junior Matriculation. All other candidates will receive statements of their standing.

7. Other candidates than those mentioned in 5 may be admitted to the examination for the purpose of qualifying for a standing other than that of Departmental Matriculation.

8. (a) Candidates may write at any one of the four University centres mentioned in 1 (a) without any additional cost to themselves.

(b) Candidates who write at any other centre, in addition to paying the fee required in (9), must also defray the local expenses of conducting the examination. These include the cost of supplies, any charge for the examination room, express charges, and the allowance to the presiding Officer at \$4 per day.

9. The fee for writing on the Supplemental Examination shall be \$2.00 for each paper or half paper, with a maximum fee of \$10.00.

10. The regular uniform examination books shall be used at this examination, and the examination shall be conducted, *mutatis, mutandis*, under the instructions governing the annual Midsummer examinations.

11. Forms of application, the time-table of the examinations, and further particulars may be obtained on application to the Department of Education, Toronto.

VI. SPECIAL STUDENTS—Students not proceeding to a degree may take any classes for which they are prepared. The work in Chemistry, Mineralogy, Geology, Drawing, Surveying, etc., is so arranged that those who wish to study these subjects, either for their scientific interest or as leading to professions other than engineering, may profitably pursue their studies here.

The Faculty will admit under this paragraph, as special students, only such candidates as it regards specially fitted to take part of the classes of a course, by virtue of mature age, or other special circumstance. It will not admit as special students those whom on account of previous poor records, it is no longer desirable to continue as regular students.

SCHOLARSHIPS AND PRIZES.

I. EXHIBITION OF 1851 SCIENCE RESEARCH SCHOLARSHIP.

This scholarship, of the annual value of £150 stg., is awarded by Her Majesty's Commissioners for the Exhibition of 1851 to students who have given evidence of capacity for original research, and (except in very special circumstances) are under 30 years of age.

The nominee must be a British subject, must have been a *bona fide* student of Queen's University for three years, must have been a student of this University for a full year immediately before his nomination, must be a student of the University at the time of his nomination, (or must have been a student at this University for a full year ending within twelve months prior to his nomination and since ceasing to be such student must have

been engaged solely in scientific study) and must pledge himself not to hold any position of emolument whilst holding the scholarship. He is recommended to the commissioners by the Senate of the University. The scholarship may be held for a second year, if the report of the first year's work be satisfactory to the Commissioners. The scholar will, in the absence of special circumstances, be required to proceed to an institution other than that by which he is nominated, and there pursue some investigation likely to promote technical industries or scientific culture. The particular investigation the student proposes to pursue must be stated before a scholarship can be awarded.

Students of the School of Mining who are registered in Queen's University are eligible for this scholarship.

The next recommendation will be made by the Senate in April, 1915.

Science Research Scholars recommended by Queen's University:

Norman R. Carmichael, M.A., 1893-94.

Thomas L. Walker, M.A., 1895-6.

Frederick J. Pope, M.A., 1897-8.

Wm. C. Baker, M.A., 1900-1.

C. W. Dickson, M.A., 1901-2-3.

C. W. Knight, B.Sc., 1904-5.

F. H. MacDougall, M.A., B.Sc., 1905-6.

C. Laidlaw, B.A., M.D., 1907-8.

N. L. Bowen, M.A., B.Sc., 1909-10.

Walter A. Bell, B.Sc., 1911-12.

2. THE CHANCELLOR'S PRACTICAL SCIENCE SCHOLARSHIP.—Value \$70. Given by Sir Sandford Fleming, C.E., K.C.M.G., LL.D., Chancellor of the University. Awarded to the student of the School of Mining obtaining the highest average on the examinations at the end of the first year.

3. THE J. B. CARRUTHERS SCHOLARSHIP.—This scholarship, of the value of \$50, the gift of J. B. Carruthers, Esq., of Kingston, is awarded annually to the student of the first year who makes the second highest average of marks in the subjects of the first year.

4. MOWAT SCHOLARSHIP.—Value \$50. Given by Ex-Mayor Mowat. Awarded to the student of the School of Mining who obtains the highest average on the examinations at the end of the second year.

5. CANADIAN MINING INSTITUTE PRIZES.—Premiums and prizes, at the discretion of the Council, may be given annually for papers read by students during the year. Any such award will be made by the Council within three months after the Annual Meeting.

6. ENGINEERING SOCIETY PRIZES.—The Engineering Society of Queen's University offers two prizes of \$15.00 and \$10.00 for the two best papers on scientific subjects, by members of the society. These papers must be read before the society, and five papers, at least, must be presented before the prizes will be awarded. These prizes are open for competition to all students of Engineering.

7. THE M. L. HERSEY FELLOWSHIP IN CHEMISTRY.—This Fellowship, of the annual value of \$500, has been endowed by Milton L. Hersey, M.Sc., LL.D., of Montreal. It is open to graduates of all universities and technical colleges. The holder of the fellowship is expected to assist in the department of Chemistry and to devote part of his time to research.

Applications addressed to the Secretary of School of Mining, Kingston, Ont., stating qualifications and enclosing recommendations will be received up to July 31st.

8. THE DOUGLAS TUTORSHIPS.—At the beginning of session 1910-11 a gift from Dr. James Douglas, of New York, led to the establishment of a system by which first year students were tutored by men selected from the senior years. The complete success of the work led to the extension of the system to include the more difficult classes of the second year. The instruction is given in the evening and as each tutor gives his whole attention to not more than five students in a period, the result is that of individual teaching.

9. THE SCIENCE '11 SCHOLARSHIP.—The Science '11 Scholarship will be awarded in accordance with the following regulations:—

(1) Each department shall value—as a percentage—the term work of each student in each class of the second year as given in the syllabus of the courses in the calendar.

(2) Each department shall be free to employ whatever methods it may find most suitable in the determination of the value of the term work of the various students.

(3) The scholarship shall be awarded by the Faculty to the student whose average percentage shall be found to be the highest; it being understood that this average has been taken all over the second year classes of the particular course for which the student is registered.

10. THE N. F. DUPUIS SCHOLARSHIP.—This scholarship has been founded by the graduates as a mark of their appreciation of the long and effective services of Dr. N. F. Dupuis, as Dean of the Faculty and Professor of Mathematics. The scholarship is of the value of \$60, and is awarded to the student who makes the highest marks in Mathematics I (including Descriptive Astronomy) at the April Examinations.

REGULATIONS.

N.B.—Students taking a regular course are subject to all rules and regulations immediately upon publication, unless otherwise specified.

1. REGISTRATION.—All students are required to register and pay the registration, athletic and class fees within three days of the opening of the session. A student who fails to register within this time must pay an additional fee of \$3.00. No student proceeding to a degree will be allowed to enter upon the work of a session after October 31st, except that under special circumstances students may be admitted to the first year after October 31st.

2. ATTENDANCE.—Students are required to attend 80 per cent. of class lectures before permission will be given to write on examinations, and 80 per cent. of laboratory hours before laboratory work will be certified. Exemption from this rule can be obtained only on application to the Faculty.

3. COURSES.—All students must take the subjects required in their courses in conformity with the calendars of their years of attendance. If a student wishes to change his course he must first obtain the permission of the Faculty.

4. SESSIONAL EXAMINATIONS.—All examinations for degrees are held under the direction of Queen's University. Candidates must make application for permission to write on such examinations, on forms supplied by the Registrar. Fees for the April examinations must be paid to the Registrar not later than March 23rd, and for the supplemental examinations not later than September 1st. Sessional examinations are held in all the subjects prescribed in the various courses, 40% being required for pass standing. In determining a student's standing at a sessional examination, professors are empowered to take into account his entire class record.

Regular students must take the April examinations in all subjects in which they are registered and in which these examinations are held. Failure in more than four classes, including practical classes in which no written examinations are held, involves the loss of the session. A student failing in not more than four classes is given supplemental examinations in the following September; if he fails in more than two of these examinations he must repeat the whole work of the year except those subjects in which his standing is second division (55%) or higher. A student shall not enter the third year until he has passed all the examinations of the first year nor into the fourth year until he has passed all the examinations of the second year. In this connection each of the three sections of Mathematics I counts as one class, and each of the two sections of Physics I as one class, and all other classes count as one each.

5. CHRISTMAS EXAMINATIONS.—Examinations will be held for first year students on the last four days before the Christmas vacation, under the same conditions as the April examinations, except that they will be restricted to two hours each. Any student failing to secure 40 per cent. in more than four of these examinations will be refused admission in the following spring term, half class fees being returned.

Examinations in all classes of the second year will be held during the last week of the first term or such time as may be necessary. Every student must write the examination in each class which he attends, the examination to be restricted to two hours. The marks given in these examinations will count 25 per cent. of the total for the year.

Examinations are held in certain subjects of other years, which are duly announced. The marks for these examinations may amount to as much as 25 per cent. of the total for the year.

6. PRACTICAL WORK.—Students are required to take the practical courses given in the calendar unless they have followed similar courses in other educational institutions, but instructors may, at their discretion, modify the work in the case of students who have had experience in the field, in engineering works, etc. Such students may be set immediately at more advanced work than that required of those who have not had such experience.

7. EXCURSIONS.—The excursions are compulsory for all students in Mineralogy and Mining. (See Field Classes in Geology and Prospecting, page 55).

8. A candidate for a degree in one of the four years' courses must make application and pay the fee to the Registrar of the University before March 23rd. If the candidate fails in his examination the fee will be returned.

9. GRADUATION WITH HONOURS.—Honour standing will be given to any student who graduates with an average of seventy-two per cent. or upwards upon the whole of the fourth year work in his course. Credit for Honour standing will be given on the diploma and in the list of graduates a mark of distinction will be placed with the names of those graduating with Honour standing.

10. EXTRA-MURAL STUDENTS.—Students who are not able to attend the School may register in the classes of Junior English, Junior and Senior Chemistry, Elementary Mineralogy and Geology, as extra-mural students of Queen's University (see Calendar of Queen's University). Tutors are appointed to assist them by correspondence.

11. FEES.—Laboratory fees must be paid before students begin work in the laboratories. Examination, degree graduation, *ad eundem statum*, and University registration fees, are payable to the University Registrar. All other fees are payable to the Treasurer of the School of Mining. Graduation and Spring examination fees must be paid before March 23rd; supplemental examination fees before Sept. 1st.

Registration for Students of the School of Mining.....	\$10 00
Registration for Arts and Medical Students.....	1 00
Engineering Society	2 00
Athletics	3 00
Students failing to register within three days of opening of session must pay an extra fee of	3 00
Change of classes after registration	2 00
Certificate of Standing	1 00

FEES FOR A COURSE.

These fees cover all class and laboratory fees for a course.

Per session, First Year Students.....	\$75 00
Per session, Second Year Students.....	85 00
Per session, Third Year Students	95 00
Per session, Fourth Year Students.....	95 00

Students registered 1906-7 to 1908-9 will pay a fee of \$60 per session.

Students registered 1905-6 or previously will pay a fee of \$50 per session.

FEES FOR SINGLE CLASSES, &c.

These are not additional to the sessional fees.

Any course of Lectures	\$12 00
Drawing, One Course, per session.....	12 00
Surveying, One Course, per session.....	12 00
Assaying Laboratory, per session	5 00
Chemical Laboratory, per session.....	15 00
Petrographical Laboratory, per session.....	5 00
Mechanical and Engineering Laboratory, per session.....	15 00

GRADUATION AND OTHER FEES.

Graduation B.Sc.	\$20 00
“ M.Sc.	20 00
“ D.Sc.	50 00
“ Diploma, three years' course	10 00
Admission <i>ad eundem statum</i>	10 00
Examination Fee, April or September	10 00

DEPOSITS.—For covering expenses of breakages, etc., a student must deposit \$5 with the Treasurer. If at any time the amount of breakages, etc., exceeds \$3, an additional deposit of \$5 must be made. Charges will be made for the use of platinum, and specially expensive chemicals and apparatus. All money to the credit of the depositors will be returned at the end of the session on presentation of the deposit receipt properly certified.

DEGREES.

1. The degree of B.Sc. will be given at the satisfactory completion of a four years' course in any one of the following departments:—

- (A) Mining and Metallurgical Engineering.
- (B) Analytical and Applied Chemistry.
- (C) Mineralogy and Geology.
- (D) Chemical Engineering.
- (E) Civil Engineering.
- (F) Mechanical Engineering.
- (G) Electrical Engineering.

2. The degree of B.A. and B.Sc. will be given at the satisfactory completion of a six years' course in Arts and Science according to the description on page 37.*

A CANDIDATE FOR GRADUATION must have completed either a four or a six years' course and have passed all the required examinations.

A graduate in any course who desires to take the degree of B.Sc. in any other course, or a student desiring to change from one course to another, shall take all the classes which he has not already passed, in that course, or, by examination satisfy the Department in charge of those classes as to his knowledge of the subjects involved.

CERTIFICATES of standing may be obtained from the Secretary on payment of the fee of one dollar.

3. The degree of Master of Science (M.Sc.) is granted to candidates who have graduated as B.Sc. and thereafter:—

a. Have practiced their profession for at least two years (one year of which must have been responsible engineering or scientific work).

*The degree of M.A. and B.Sc. may be obtained in seven years in properly selected courses. See page 37.

or *b.* Have spent at least one session in attendance at the School of Mining after graduation as B.Sc.

In either case the candidate must have carried on research work, the results of which must be submitted, on or before March 30th, in the form of a thesis satisfactory to the Faculty. The literary as well as the scientific quality of the thesis is considered.

In addition to this, an examination is required, on subjects kindred to that treated in the thesis. The candidate must give notice of his intention to proceed to the degree at least six months before he presents himself for examination, and must at the same time submit for approval the subject of his research. The subjects for examination will then be assigned by the Faculty.

4. The degree of Doctor of Science (D.Sc.) is granted to candidates who have graduated as M.Sc., or have otherwise satisfied the Faculty of their ability to proceed, and have thereafter fulfilled the conditions which here follow.

The degree is not granted until after at least three years from the time of graduation as M.Sc. unless one session is devoted to research in an approved university or school of engineering or applied science, in which case the degree may be granted at the end of two years from the time of graduation as M.Sc.

The candidate must submit a thesis embodying the results of his original and independent research in some subject of importance to science. The literary as well as the scientific quality of the thesis is taken into account in judging the candidate's fitness to proceed to the examination.

The candidate must make application in writing to the Secretary at least two years before he proposes to present himself for examination, and must at the same time submit for approval the subject of his research. The subjects of the examination, which will be cognate to that of the thesis, will then be assigned by the Faculty, and will include a reading knowledge of either Scientific French or German.

5. B.A. and M.A. courses in Chemistry, Assaying, Mineralogy, Geology, etc. (See Calendar of Queen's University).

DOMINION LAND SURVEYORS.

The Degree in Mining or in Civil Engineering of the School of Mining, Kingston, is equivalent to the "diploma as Civil Engineer" mentioned in Clause III of the Dominion Lands Act; so that a candidate for D.L.S. having that degree from the School of Mining is entitled to examination after one year's service with a D.L.S.

ONTARIO LAND SURVEYORS.

The Ontario Land Surveyors' Act, 55 V., c. 34, s. 18, (28). "The privilege of a shortened term of apprenticeship shall be accorded to any graduate of . . . the School of Mining, Kingston, in Civil Engineering, or in Mining Engineering, and such person shall not be required to pass the preliminary examination hereinbefore required for admission to apprenticeship with a land surveyor but shall only be bound to serve under articles with a practising land surveyor, duly filed as required by section 32 of this act, during twelve successive months of actual practice, after which, on complying with all the other requirements, he may undergo the examination prescribed by this Act."

COURSES.

- (A) Mining and Metallurgical Engineering.
- (B) Analytical and Applied Chemistry.
- (C) Mineralogy and Geology.
- (D) Chemical Engineering.
- (E) Civil Engineering.
- (F) Mechanical Engineering.
- (G) Electrical Engineering.

A.—MINING AND METALLURGICAL ENGINEERING.

This course is necessarily a very broad one, so that it may give a foundation for whatever branch of these professions a graduate may follow. Experience has shown that graduates do not usually follow any narrow differentiation which they make during their course, but are governed by many other factors in the practice of Mining and Metallurgical Engineering. These factors are often out

of their control, and the wisest plan in a four years' course, appears to be, not to specialize, but by a broad training, in the final years, to obtain a suitable introduction to any branch of the work.

There are, however, some well known avenues towards professional work, such as a good training and a manipulative skill in drafting, chemical analysis, and surveying. These subjects are common, and imperative, to almost any professional position in mining and metallurgy, therefore they are perfected as far as is possible while at college.

At the present time there are no summer classes, or summer field work in mining or metallurgy, excepting the Engineering Field work of the second or third years, which work takes place early in May. Under these conditions the student can, usually, obtain practical and remunerative work, during four or five months each summer. This work, if in connection with Mining, Metallurgy or Surveying is considered to be more useful as a training than practical work under academic supervision.

The degree of B.Sc. is given upon the completion of this course, and evidence of at least six months spent at work in connection with mines, metallurgical works, surveying or geology.

FIRST YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Junior English	4		39
Mathematics I	8		40
Physics I	4	2	42
General Chemistry I	2	3	45
Drawing I	1	4	86
Surveying I	1		86
Junior French (optional)			
Junior German (optional)			39
Physical Drill		2	90

SECOND YEAR.

Mathematics II		2	90
Mathematics III	3		41
Descriptive Geometry	1	2	41
Physics II	2	2	43
Analytical Chemistry I		3	46
Analytical Chemistry III		3	46
General Chemistry II	1		46
Mineralogy I	1	2	50
Mineralogy III	2(b)		51
Geology I	2		54

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Drawing II	1	3	86
Surveying VI	1	3	86
Workshop		3	89
Engineering Field Work, April, May			73

THIRD YEAR.

Analytical Chemistry IV		5	46
Mineralogy IV		4	52
Geology II	1(a)		55
Geology III	2	2	56
Geology IV	2(a)		56
Geology V	1(b)		57
Mining I	2		61
Ore Dressing	2		61
Metallurgy I	2		65
Fire Assaying		4(b)	66
Thermodynamics I	2(a)		69
General Engineering I	2		70
General Engineering III		2	70
Electrical Engineering I	1(a)	2(b)	74
Surveying VII	1	2	87
Mechanical Engineering VII	1		83

FOURTH YEAR.

Industrial Chemistry II	1		48
Mineralogy VI	1		52
Geology VIII	2		58
Mining II	3		62
Milling		11	63
Metallurgy, Mining and Mill Designing or (Mining and Metallurgy IV)		5	63
Summer Essay			63
Metallurgy II	4		65
Metallurgy III	1		66
General Engineering II	2		70
Hydraulic Engineering I	2		80
Mechanical Engineering IV	2		82
Economics	1		89

NOTE—The letters (a) and (b) denote first and second terms, respectively.

B.—ANALYTICAL AND APPLIED CHEMISTRY.

This course is intended to prepare candidates to enter upon the practice of chemical analysis, to fit them for positions in the laboratories of metallurgical, mining, food and other manufacturing works; also for the profession of public analyst, and for other positions where a thorough knowledge of chemical analysis and mineralogy is required. The first two years are devoted to those subjects that serve as an introduction to the more specialized work of the last two years. The advanced work of the fourth year deals mainly with practice in analysis of the products of those industries that are being developed in Canada at the present time.

FIRST YEAR.

Same as first year *Course A*.

SECOND YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
German	3		39
Mathematics II	3		40
Mathematics III	3		41
Physics III	1	2	43
Analytical Chemistry I		3	46
Analytical Chemistry II		2	46
Analytical Chemistry III		3	46
Analytical Chemistry IV		5	46
General Chemistry II	1		46
Organic Chemistry I	1	2	47
Mineralogy I	1	2	50
Mineralogy II	3(a)		

THIRD YEAR.

Analytical Chemistry V		5	46
Analytical Chemistry VI		5	46
Organic Chemistry II	1	3	46
Physical Chemistry I	1	3	47
Industrial Chemistry I	2	4	48
Physical Chemistry III		2	48
Mineralogy III	2(b)		51
Mineralogy IV		5	52
Geology I	2		54
Metalurgy I	2		61

FOURTH YEAR.

General Chemistry III	1	2	46
Analytical Chemistry VIII		4	46
Physical Chemistry II	1	3	47
Organic Chemistry III	1	2	47
Organic Chemistry IV		4	47
Mineralogy VI	1		52
Bacteriology		2	
Fire Assaying		4(b)	66
Economics	1		89
Advanced Work—An option is allowed between A and B.			
A.—General Chemistry IV [including Petrography (4)]		12	46
B.—Organic Chemistry V		12	47

C.—MINERALOGY AND GEOLOGY.

This course is designed to meet the requirements of students who desire a theoretical and practical knowledge of the constitution and history of the Earth. It furnishes a foundation for the profes-

sions of Mineralogist, Geological Surveyor and Mining and Consulting Geologist, and is useful for those who will in any way be connected with the discovery or the development of the natural resources of the country. It forms a good preliminary course for the mining engineer who wishes to understand thoroughly the groundwork of his profession. Since a knowledge of chemistry is essential for proper comprehension of many mineralogical and geological phenomena, considerable stress is laid on this science in the earlier part of the course. The departments of Mineralogy and Geology are furnished with well equipped laboratories for the physical and chemical examination of minerals, rocks and ores, and also with collections of illustrative material. While field excursions are made during the session, students are advised to spend the summer vacations in practical field work.

FIRST YEAR.

Same as first year *Course A*.

SECOND YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Mathematics II	3		40
Descriptive Geometry	1	2	41
Analytical Chemistry I		3	46
Analytical Chemistry II		2	46
Analytical Chemistry III		3	46
Analytical Chemistry IV		5	46
General Chemistry II	1		46
Mineralogy I	1	2	50
Mineralogy II	3(a)		51
Mineralogy III	2(b)		51
Geology I	2		54
Mining I		2	60
Animal Biology	3		60
Surveying VI	1	3	88

THIRD YEAR.

Elementary German	3		39
Analytical Chemistry V		5	46
Analytical Chemistry VI		5	46
Physical Chemistry I	1	3	47
Mineralogy IV		5	52
Mineralogy VI	1		52
Geology II	1(a)	2(b)	55
Geology III	2	2	56
Geology IV	2(a)		56
Geology V	1(b)		57
Ore Dressing	2		61

FOURTH YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Geology VI	2		57
Geology VII	1	2	58
Geology VIII	2		58
Geology X		2	50
Mining I	2		61
Metallurgy II	4		65
Surveying VII	1	1	87
Economics I	1		89
Advanced Analysis of Rocks with thesis.		20	

D.—CHEMICAL ENGINEERING.

In the construction and operation of chemical works and also in metallurgical enterprises in which the processes are of the more complicated kind there are often required the services of a man who combines a thorough knowledge of chemistry with the education of an engineer; but the chemical engineer must have at his command not merely the elements of general engineering, but also a competent knowledge of those materials of construction and the special kinds of plants and processes which are in use in the works mentioned. The course in chemical engineering covers four years of study, the first two of which do not differ materially from those of the course in Analytical and Applied Chemistry, and Mining and Metallurgy. Specialization begins in the third year, the time being divided between Chemistry, and Civil and Mechanical Engineering. Specialization is continued in the fourth year, which includes in addition to advanced work in Chemistry and Chemical Engineering, the subjects of Metallurgy, and Electro-Chemistry.

Visits are paid to local and to at least one outside chemical works, at which attendance is required.

FIRST YEAR.

Same as first year, *Course A*.

SECOND YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Mathematics II	3		40
Mathematics III	3		41
Descriptive Geometry	1	2	41
Physics III	1	2	43
Analytical Chemistry I		3	46

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Analytical Chemistry II		2	46
Analytical Chemistry III		3	46
Analytical Chemistry IV		5	46
General Chemistry II	1		46
Organic Chemistry I	1	2	47
Mineralogy I	1	2	50
General Engineering I	2		69
Drawing II		3	86

THIRD YEAR.

Analytical Chemistry V		5	46
Physical Chemistry I	1	3	47
Industrial Chemistry I	2	3	48
Metallurgy I	2		65
Thermodynamics I	2(a)		69
Thermodynamics II	1(b)		69
General Engineering II	2		70
General Engineering III	2		70
Electrical Engineering I	1(a) 2(b)		74
Mechanical Engineering I	4(a)		82
Mechanical Engineering III		4	82
Mechanical Engineering VII		1	85
Workshop		3	89

FOURTH YEAR.

Analytical Chemistry VI		5	46
General Chemistry III	1	2	46
Physical Chemistry II	1	3	47
Metallurgy II	4		65
Fire Assaying		4(b)	66
Chemical Engineering I		3	68
Chemical Engineering II		10(a) 6(b)	68
Structural Engineering I	1	3	81
Mechanical Engineering IV	2		82
Economics	1		89

E.—CIVIL ENGINEERING.

In this course the two main divisions of Civil Engineering, namely Surveying and Draughting on the one hand, and Structural Design and Construction on the other, receive full consideration. During the earlier years of the course a sound training along engineering lines is given in Mathematics, Physics, Mechanics and other allied subjects, which are essential to the proper education of an engineer. The student is also made familiar with the use of the various instruments, and by many hours of practical work in the field and draughting room, becomes skilled in the ordinary operations of Surveying. During the same period the foundation work for structural design is laid by courses of lectures in materials of

construction, as well as by demonstrations and practical work in the testing laboratories. The second year is closed by two weeks of Engineering Field Work, whereby the student is brought into contact with the problems of railway location, and hydrographic surveying. During the final years more highly specialized instruction and training are given along the lines of the two main divisions, with particular regard to the economic conditions of modern construction. At frequent intervals excursions are undertaken to the quarries, cement works, brick kilns, bridges, railway structures, canals and graving docks, which are to be found within easy distance of Kingston.

FIRST YEAR.

Same as Course A.

SECOND YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Mathematics II	3		40
Mathematics III	3		41
Descriptive Geometry	1	2	41
Physics II	2	2	43
Analytical Chemistry I		3	46
Mineralogy V	1(a)		52
Geology I	2		54
General Engineering I	2		70
Drawing II		3	86
Surveying II	2	3	86
Surveying III	1½	2½	86
Workshop II	4		89
Engineering Field Work I	Two weeks		71

THIRD YEAR.

Analytical Chemistry VII		3	46
Metallurgy I	2		65
Thermodynamics I	2(b)		69
Thermodynamics II	1(b)		69
General Engineering II	2		70
General Engineering III		2	70
General Engineering VI	1	3(b)	71
Engineering Field Work II		3(b)	73
Electrical Engineering I	11(a)	2(b)	74
Railway Engineering I	2	2	77
Hydraulic Engineering I	2		80
Structural Engineering I	1	3	81
Mechanical Engineering VII	1		83
Surveying IV	1	2	86
Surveying V	½	2½	86

FOURTH YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Industrial Chemistry II	1		48
Geology IX	1(a)		59
General Engineering IV		2	71
General Engineering V	1		71
Engineering Field Work III.....		4	73
Railway Engineering II	1	2	77
Railway Engineering III	2		77
Municipal Engineering I, II, III, IV	3	3	78
Hydraulic Engineering II	1		80
Hydraulic Engineering III	1		80
Hydraulic Engineering IV	1		80
Structural Engineering II	1	3	81
Structural Engineering III	1	3	81
Mechanical Engineering IV	2		82
Economics	1		89
Workshop II		2	89

F.—MECHANICAL ENGINEERING.

The profession of Mechanical Engineering embraces the design, manufacture and operation of all classes of machinery, of power plants and manufacturing plants, as well as the executive management of industries. A four years course therefore must be broad enough to give the student a thorough training in the fundamental principles, and any subdivisions intended to train a student for any one of the many specialties only, seem unwise, and are impracticable on account of the lack of time.

The first two years are devoted to the study of the fundamental subjects of Mathematics, Physics, Chemistry, and Mechanics, including experimental work in the various laboratories. Special attention is given to the subject of strength of materials, with practice in testing during the second and third years. The study of the steam engine, and other forms of heat-engines, includes courses in Thermodynamics, Valve Gears, Governors and the Balancing of Engines. Instruction is given in Mechanism, Machine Design, Shop Work, and the fundamental principles of Electrical Engineering. Instruction in drawing extends over the four years, and gives a thorough drill in modern drafting room practice. In the more advanced courses of the fourth year the student is taught how to supply the general principles to the design and operation of

special machinery, of steam and gas engines, of steam boilers and gas producers, and of complete power plants; and the instruction in the laboratories is intended not only to familiarize the student with standard methods of testing, but also to teach him how to attack original problems.

The fourth year students are kept in touch with the local manufacturing concerns in order to familiarize them with modern power plant and shop practice.

FIRST YEAR.

Same as first year *Course A*.

SECOND YEAR.

Mathematics II	3		40
Mathematics III	3		41
Descriptive Geometry	1	2	41
Physics II	2	2	43
Physics III	1	2	43
Analytical Chemistry I		3	46
General Engineering I	2		70
Mechanical Engineering VII	1	3	83
Drawing III		6	86

THIRD YEAR.

Industrial Chemistry II	1		47
Metallurgy I	2		65
Thermodynamics I	2(a)		69
Thermodynamics II	1(b)		69
Thermodynamics V		4	69
General Engineering II	2		70
General Engineering III		2	70
Electrical Engineering I	1(a)	2(b)	74
Hydraulic Engineering I	1		80
Structural Engineering I	1		81
Mechanical Engineering I	2		82
Mechanical Engineering II	2		82
Mechanical Engineering III		8	82
Mechanical Engineering IV	2		82
Seminar			
Workshop I (taken during vacation)	1		87

FOURTH YEAR.

Thermodynamics III	2	4	69
Thermodynamics IV		6	69
Electrical Engineering VII		2	82
Mechanical Engineering V	1	8	82
Mechanical Engineering VI	2		82
Mechanical Engineering VIII	1	2	82
Mechanical Engineering IX	1	7	82
Economics	1		88
Seminar	1		74
Workshop II (taken during vacation)			89

G.—ELECTRICAL ENGINEERING.

The instruction in the first two years of the course in Electrical Engineering provides for a thorough training of the students in the fundamental subjects of Mathematics, Physics, Chemistry and Mechanics, including suitable work in the various laboratories. Part of the time is devoted to elementary drawing and shop work. In the third year the work consists of an introduction to the general principles underlying all electrical work together with elementary laboratory work. Considerable time is devoted to the study of Thermodynamics and advanced Mechanical Drawing. The fourth year is devoted to the study of the action and design of all kinds of electrical apparatus, the design and operation of central stations, electric lighting, electric railways and power transmission.

An important part of the work consists in the working out of problems such as are frequently met in practical work. In this way the student is trained in the application of theory to the solution of practical problems.

Arrangements are made for occasional visits to electrical works.

The whole course is designed to give the student a thorough understanding of the general principles which constitute the basis of all electrical work, together with a knowledge of how these principles are applied in practice. No effort is made to give that intimate knowledge of practical details which experience alone can supply.

FIRST YEAR.

Same as first year *Course A*.

SECOND YEAR.

Same as second year *Course F*.

THIRD YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Physics IV	1	4	44
Metallurgy I	2		65
Thermodynamics I	2(a)		69
Thermodynamics II	1(b)		69
General Engineering II	2		70
General Engineering III		2	71
Mechanical Engineering I	2		82
Mechanical Engineering II	2		82
Electrical Engineering II	4	3	74

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
Electrical Engineering III	1(a) 2(b)	2	74
Electrical Engineering IV .....	.....	5	74
Work Shop (taken during vacation).....	.....	.....	.....

FOURTH YEAR.

Electro-metallurgy	1(b) .....	.....	66
Thermodynamics III	2	4(b)	69
Electrical Engineering V	3	3	74
Electrical Engineering VI	2(a) 1(b)	3	74
Electrical Engineering VIII	1(b)	2	74
Hydraulic Engineering I	2 .....	.....	80
Mechanical Engineering IV	2 .....	.....	82
Mechanical Engineering VIII	1(a)	2(a)	83
Economics	1 .....	.....	89
Workshop (taken during vacation).....	.....	.....	.....

In addition to the above one of the following subjects must be selected:

Electrical Engineering IX	1(a) 2(b)	3	74
Electrical Engineering X	1(a) 2(b)	3	75
Electrical Engineering XI	1(a) 2(b)	3	75
Mechanical Engineering IX	1(a) 2(b)	3	83

COURSE FOR B.A. LEADING TO THE DEGREES OF B.A. AND B.Sc. IN SIX YEARS.

Students taking these courses are required to have Arts Matriculation and to register the first two years in Arts alone and pay the class and registration fees in Arts, to register the second two years in both Arts and Science, to pay both registration fees and the Science class fees and to register the last two years in Science only, paying the registration and class fees. Arts classes are subject to the regulations in the Arts Calendar, and Science classes to the regulations in the Science Calendar.

The courses for B.A. and B.Sc. must be taken as laid down in the following scheme. The regulations regarding back classes on page 25 will be applied on these courses.

(The Arts Classes are italicized.)

FIRST YEAR.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page
<i>Junior English</i>	4 .....	.....	.....
<i>Junior Latin</i> .....	.....	.....	.....
<i>Junior Greek</i> .....	.....	.....	.....
<i>Junior French</i>	Any two.....	10 .....	.....
<i>Junior German</i> .....	.....	.....	.....
<i>Junior Spanish</i> .....	.....	.....	.....
Geometry I.	3 .....	.....	40
Drawing I.	1	4	86

SECOND YEAR.

		Lect. Hrs. per week.	Lab. Hrs. per week.	Page
<i>Senior English</i>		4		
<i>Senior Latin</i>	} Any one	5		
<i>Senior Greek</i>				
<i>Senior French</i>				
<i>Senior German</i>				
<i>Economics</i>	} Any one	3		
<i>Politics</i>				
<i>Animal Biology</i>	} Any one	3		
<i>Colonial History</i>				
<i>Trigonometry</i>		2		40
<i>Algebra and Astronomy</i>		3		40

THIRD YEAR.

<i>Senior Philosophy</i>	} Any one	3		
<i>Junior Philosophy</i>				
<i>Physics I.</i>		4	2	42
<i>Chemistry I.</i>		2	3	45
<i>European History</i>	} Any one	3		
<i>English History</i>				
<i>Surveying I.</i>		1		86
<i>Physical Drill</i>			2	90
<i>Drawing II</i>			3	86

Fourth, Fifth and Sixth Years are the same as Second, Third and Fourth Years of any of the courses in the School of Mining with the exception of Drawing II, which appears in the Third Year of the course outlined above.

If a student on one of these courses wishes to specialize in one or more of the Arts subjects, he may do so in the honour classes.

Attention is called to the fact that by proper selection of classes an entire Arts course leading to the degree M.A., and a B.Sc. course in the School of Mining, can be completed in seven years.

SUBJECTS OF STUDY.

ENGLISH LANGUAGE AND LITERATURE.

PROFESSOR—James Cappon, M.A.

ASSISTANT PROFESSOR—John F. Macdonald, M.A.

JUNIOR CLASS.

1. Practical course in Rhetoric and Composition.

(a) General Theory and Illustrations.

(b) Exercises on the above with essays.

Sections A, B, C, Mon. and Wed. at 8; sections D, E, F, Mon. at 10, Thurs. at 8. Professor Macdonald.

Text-book.—Wooley, "*Handbook of Composition*" (Heath and Co.).

2. Study of Prose Authors in selected passages. Development of English prose as illustrated by Bacon, Addison, Johnson, Macaulay, Ruskin, Carlyle, Huxley, Arnold and others. *Selected English Essays* (World's Classics Series).

Sections A, B, C, Tues. at 1, Fri. at 8; sections D, E, F, Tues at 8, Fri. at 1; second term. Professor Macdonald.

3. A detailed study in class of the following:—

Shakespeare,—*Macbeth*.

Wordsworth,—*Lines written near Tintern Abbey, Song at the Feast of Brougham Castle, The Blind Highland Boy, The Solitary Reaper, The World is Too Much With Us, I wandered Lonely as a Cloud, The Happy Warrior.*

Sections A, B, C, Tues. at 1, Fri. at 8; sections D, E, F, Tues at 8, Fri. at 1; first term. Professor Macdonald.

GERMAN.

PROFESSOR—J. Macgillivray, Ph.D.

PREPARATORY CLASS.

This course includes a study of the elements of grammar and the construction of sentences, practice in the use of a general vocabulary and drill in pronunciation and dictation. It also includes the reading of texts with practical exercises.

Text-books:—*Ontario High School German Grammar.*

Ontario High School German Reader.

Baumbach Neue Märchen.

Lectures—Mon. 4-5, Wed. 4-5, Thurs. 5-6.

MATHEMATICS.

PROFESSOR—J. Matheson, M.A.

ASSISTANT PROFESSOR—D. S. Ellis, M.A., B.Sc., D.L.S., O.L.S.

ASSISTANT PROFESSOR—D. Buchanan, Ph.D.

ASSISTANT PROFESSOR—C. F. Gummer, M.A.

LECTURER—J. A. Workman, M.A.

In order that the class work may be done as effectively as possible each class is divided into two sections.

MATHEMATICS I.

This class will meet for the study of Mathematics eight hours per week, of which one hour per week during the second term is given to Astronomy. The subjects are as follows:—

(1) Algebra, including the leading parts of the subject such as multiplication, division, expansion into series, fractions, indices and surds, proportion, graphing of functions, quadratics, permutations and combinations, binomial theorem, undetermined coefficients, summation of series, continued fractions, logarithms, exponentials.

Sections A, B, C—Tues. 8-9, Thurs. 8-9, Fri. 9-10.

Sections D, E, F—Mon. 11-12, Wed. 9-10, Fri. 11-12. Professor Gummer.

(2) Elementary Geometry, including the first three parts of Dupuis' *Plane Geometry*, together with the first 131 pages of Dupuis' *Solid Geometry*; and an introduction to Analytic Geometry. Particular attention is given to practical applications of geometric principles.

Section A, B, C—Mon. 9-10, Tues. 11-12, Thurs. 11-12.

Sections D, E, F—Tues. 9-10, Wed. 9-10, Thurs. 9-10. Professor Ellis.

(3) Trigonometry, including the fundamental principles and formulae, the nature and use of logarithms and tables, and inverse functions. There are numerous exercises and applications; and a great portion of practical work is done by means of natural functions.

Sections A, B, C—Wed. 11-12, Fri. 11-12.

Sections D, E, F—Tues. 11-12, Fri. 9-10. Mr. Workman.

(4) Elements of Descriptive Astronomy, as in Dupuis' *Elements of Astronomy*.

Section A, B, C—Fri. 9-10; second term.

Sections D, E, F—Fri. 11-12; second term. Professor Ellis.

In all these subjects exercises are required.

MATHEMATICS II.

(1) Elementary co-ordinate geometry of two and three dimensions with applications to the curves and surfaces commonly occurring in engineering practice.

(2) Mensuration of areas, surfaces and volumes; mean centre of points and figures; Pappus' theorems and their applications.

(3) Spherical trigonometry and its applications to geodesy, astronomy, etc.

Mon. 10-11, Tues. 10-11, Thurs. 10-11. Professor Matheson and Dr. Buchanan.

MATHEMATICS III.

Differential and integral calculus, with applications to curves and curve tracing; measurement of the lengths of curves, the areas of surfaces, and the volumes of solids; mass centre; centre and moment of inertia; radius of gyration; mechanical quadrature, and Weddle's formula; differential equations.

Tues. 8-9, Wed. 1-2, Fri. 8-9. Professor Ellis and Mr. Workman.

Mathematics II and III are taken in the second year of the course.

Numerous exercises are given in all divisions of the subjects.

DESCRIPTIVE GEOMETRY.

LECTURER—O. G. Wellton, M.E.

Division of Space into four quadrants. Orthogonal projections of a point in the four quadrants. Orthogonal projection of a line in all the quadrants. Parallel-perspective representations of points and lines in all the quadrants. The length of a line, traces of a line. Intersecting lines. Representations of infinite planes. Intersection of a line and a plane; intersections of two and more planes. Perpendicular to a plane. Inclination of a plane to the horizontal and vertical planes of projection. Rotation of planes about a fixed axis. Parallel planes; distance between them. Perpendicular to a line in general. Common perpendicular to any two lines in space. Intersection of solids.

Generalization of different modes of projection by introducing central projection. Its application to perspective representation on one plane. Conception of the horizon as the locus of intersection of all parallel horizontal lines. Perspective representations of solids bounded by planes.

Central projections as applied to shadows thrown by lines, definite planes and solids. Shades and shadows of cones, pyramids, spheres, etc., on one, two or more planes, when the source of light is at an infinite distance.

Intersection of curved surfaces.

The students are drilled in the subject by numerous applications in the draughting room.

Lecture—A, C, D, E, F, G, Thurs. 1-2.

Draughting room—A and C, Mon. 3-5; E and D, Wed. 10-12; F and G, Fri. 2-4.

Text-book—Millar "*Descriptive Geometry.*"

PHYSICS.

PROFESSOR—A. L. Clark, Ph.D.

ASSOCIATE PROFESSOR—W. C. Baker, M.A.

ASSISTANT PROFESSOR—J. M. Adams, M.A., Ph.D.

LECTURER—V. E. Pound, M.A.

DEMONSTRATORS—W. H. Adamson, C. S. Allin, C. B. Bate, J. A. Bennie, J. W. Campbell, J. E. Fraser, H. L. Howson, A. E. Thompson.

The work in Physics is carried on in lecture and laboratory courses, which run parallel to each other. In the lecture room the fundamental principles are developed and applied, experimental demonstrations given and many problems solved. In the laboratory a large number of experiments are performed. These are designed to train the student in manipulation of apparatus and instruments of precision, to teach him to make accurate measurements and to give practice in properly recording, interpreting and reducing experimental data. The laboratory course is a most valuable part of the work, supplementing as it does the work of the lectures and giving a better understanding of the principles of Physics. Opportunity is offered for advanced work in the various parts of the subject in the Arts Honour Courses. See Arts Calendar.

PHYSICS I.

This class is required of first year students in all courses and is elementary, no previous knowledge of the subject being necessary. Students in this class have opportunity for assistance by Douglas tutors. (See page 19). The work is divided into two parts as follows:—

“A”—MECHANICS.

In this part of the work the foundations of Mechanics are discussed with special emphasis on the establishment of the fundamental principles and relations. The aim is to reduce to exact statement that knowledge of matter and motion that is the common possession of all students. Numerous experiments are shown, not so much to supply new facts as to focus the attention

on the quantitative aspect of phenomena already familiar. This is followed by the solution of many numerical problems taken from cases within the experience of the student, emphasizing the relations that have been established in the lectures. In this way the student is led to lay for himself a firm foundation for all later work in Physics, both cultural and technical and for work in Engineering where clear understanding of the principles of Mechanics is all important.

Lectures—Wed. and Fri., 10-11. Professor W. C. Baker.

"B"—ELECTRICITY AND MAGNETISM, SOUND, LIGHT AND HEAT.

This part of the work consists of lectures on Magnetism, Electricity, Wave Motion, Sound, Light, and Heat, which are discussed both mathematically and experimentally. The lectures are fully illustrated by suitable experiments. Independent effort on the part of the student is considered essential to a proper understanding of the fundamental principles in this course, hence many problems are given for solution during the year.

Lectures—Tues. and Thurs. 10-11. Professor Adams.

Laboratory—Section A, B, Mon. 1-3; C, D, Wed. 1-3; E, F, Thurs. 1-3.
Mr. Pound.

Text-book—Kimball, *College Physics*.

PHYSICS II.

This class is required of students in Courses A, E, F and G.

This is a course of lectures on Elementary Applied Mechanics and is a continuation of Physics I. Math. II and III are taken at the same time as this class, consequently during the latter part of the year the Calculus is used freely. A general review of the important fundamental principles of Mechanics occupies the first few weeks. These are then applied to problems dealing with Motion in a Circle, Simple Harmonic Motion, Moments of Inertia, Rotation, Friction of Belts, Pivots and Bearings, Elasticity in Stretching, Bending, and Twisting, Energy and its Transformations, etc. Throughout the year, weekly exercises are done by the students, which are discussed in class later. The students in this class, like those in Physics I, have the benefit of tutorial assistance.

Lectures—Mon. and Wed. 8-9. Professor Clark.

The laboratory work, which runs parallel with the lectures, is a continuation of the work of the first year.

Laboratory—Courses F, G, Mon. 3-5; Course E, Tues. 3-5; Course A, Sat. 9-12. Professors Baker and Adams.

PHYSICS III.

This class is required of second year students in Courses B, D, F and G.

This course of one lecture a week throughout the year is intended for those intending specializing in Electricity, Electrical Engineering or Electro-

Chemistry. It is intermediate in character between the first year course in Electricity (Physics I, B) and the distinctly technical courses of the later years given in the Engineering Departments. It is essentially a course in the solution of electrical problems, and includes a thorough discussion of Ohm's Law, Shunts, Available Voltage, Electrical Energy, Power, Kirchhoff's Laws, Laws of Electrolysis, Electromotive forces of cells, the Magnetic circuit and Electromagnetic Induction. The problems are largely taken from practice, and particular attention is paid to discussing the principles of the results obtainable from data given.

Lecture—Mon. 9-10. Professor Adams.

TEXT-BOOK—Hadley, *Magnetism and Electricity for Students*.

The laboratory work of this class consists of a course of experiments in electrical measurements, involving such things as measurement of Resistance by Wheatstone's Bridge, determination of various electrical and magnetic constants, a study of such electrical instruments as galvanometers, ammeters and voltmeters and the simple potentiometer. Emphasis is laid on clear understanding of experiments, accuracy of results, writing of reports and discussion of accuracy.

Laboratory—Tues. 3-5. Professor Clark.

PHYSICS IV.

Required of third year students in Course G.

The work of this class comprises a course of lectures on the Elementary Mathematical Theory of Electricity and Magnetism, and a course of laboratory experiments in advanced electrical measurement.

In the lectures are treated such topics as the more important laws and theories in Electrostatics, the properties and laws of the Magnetic Field, Electrodynamics and Electro-magnetic Induction. A brief treatment of Electro-magnetic Waves is given and systems of units and the modern trend of the electro-magnetic theory are discussed. Many problems are assigned for solution and discussed in class.

Lecture—Mon. 10-11. Professor Clark.

In the laboratory the students make detailed study of several groups of experiments in which accuracy is of prime importance. These comprise careful study of galvanometers using both steady and transient currents, measurements of capacities, permeability, insulation resistance, and self and mutual induction, the use of the potentiometer in measurement of electromotive force of cells, and calibration of voltmeters and ammeters, and study of electrical waves.

Laboratory—Wed. 1-5. Professor Clark.

In all of the courses in Physics, the work in the laboratories will count a certain percentage of the whole work of the session. In estimating the standing in the laboratory work, both the quantity and quality of the work done will be considered.

PHYSICAL LABORATORIES.

The Physics Department is located in the southern half of Ontario Hall, which contains a large lecture room, with a seating capacity of 125, a small lecture room with seating capacity of 60, a small class room, two large rooms equipped as general elementary laboratories and one room equipped as an electrical laboratory for advanced work. Besides these rooms are the offices for the staff, a large, well-lighted library and reading room, smaller rooms for special purposes, apparatus and store rooms. The equipment for lecture table and laboratory is steadily growing and comprises all of the more important pieces of apparatus for these purposes.

LIBRARY.

The library contains text-books, works of reference, and journals devoted to Physics and related subjects. These may be freely consulted by the student in the reading room between the hours of 8 a.m. and 5 p.m. Books may in general be taken from the building over night upon reporting to a member of the staff and making a record in a book provided for that purpose. It is only by special permission, however, that any book may be kept away longer than one night at a time.

CHEMISTRY.

PROFESSOR—W. L. Goodwin, D.Sc., F.R.S.C.

ASSOCIATE PROFESSOR—W. O. Walker, M.A.

ASSISTANT PROFESSOR—John Waddell, B.A., Ph.D., D.Sc.

ASSISTANT PROFESSOR—Leo F. Guttman, A.C.G.I., Ph.D., F.I.C.

ASSISTANT PROFESSOR—W. D. Bonner, M.A., Ph.D.

LECTURER—J. A. McRae, M.A., A.I.C.

FELLOW—E. S. Bishop, B.Sc., M.A.

DEMONSTRATORS—J. R. Tuttle, M.A.

J. D. Detweiler, B.A.

A. F. G. Cadenhead.

GENERAL CHEMISTRY.

I. ELEMENTARY—An introductory course in general chemistry with experimental demonstrations.

Lectures—Mon. 11-12; Sections A, B, C, Wed. 9-10; Sections D, E, F, Wed. 11-12. Professor Goodwin.

Laboratory—Sections A, B, C, Fri. 1-4; Sections D, E, F, Tues. 1-4. Professors Goodwin and Walker.

Text-books—Smith, General Chemistry for Colleges, (The Century Co.) Laboratory Manual of General Chemistry.

II. INTERMEDIATE—General Chemistry of the Metals, with particular reference to the theory of qualitative analysis.

Lecture—Thurs. 8-9. Professor Bonner.

Text-book—Smith, General Chemistry for Colleges.

III. ADVANCED—A course of lectures on advanced general chemistry.

Lecture—Mon. 8-9. Professor Waddell.

Laboratory—Mon. 1-3.

IV. ADVANCED INORGANIC WORK.

Eight (8) hours to be arranged. Professor Waddell, Guttman, or Bonner.

ANALYTICAL CHEMISTRY.

I. INTRODUCTORY QUALITATIVE ANALYSIS.

Courses A, B, C, Fri. 1-4; E, F, G, Tues. 11-12, 1-3; D, Tues. 9-10, 1-3.

Professor Bonner and Mr. McRae.

II. QUALITATIVE ANALYSIS OF SOLIDS, INCLUDING ALLOYS.

Courses B, C, D, Mon. 1-3. Mr. McRae.

III. QUALITATIVE ANALYSIS OF MINERALS.

Courses A, B, C, Wed. 9-12; D, Fri. 1-4. Professor Bonner.

Text-book—Laboratory Manual of Qualitative Analysis.

IV. INTRODUCTORY QUANTITATIVE ANALYSIS, Barium Chloride, Alkalimetry and Acidimetry, Calcium Carbonate, Magnesium Sulphate, Coal, Bleaching Powder, Iron Ore, Copper Ore, Nickel Ore, Lead Ore.

Courses A, Wed. 2-4, Fri. 1-4; B, C, Tues. 1-3, Sat. 8-12, second term.

D, Wed. 8-10, Sat. 8-12. Professor Waddell.

V. INTERMEDIATE QUANTITATIVE ANALYSIS. Feldspar, Titaniferous Iron Ore, Zinc Ore, Arsenic Ore, Chromite, Barite, an Alloy.

Courses B, Thurs. 1-3, Fri. 1-4; C, Mon. 9-10 and 3-4, Thurs. 8-9 and 1-3.

D, Wed. 1-2, Thurs. 8-12. Professor Waddell.

VI. ADVANCED QUANTITATIVE ANALYSIS. Selected problems and exercises in quantitative analysis.

Courses B, Thurs. 1-3, Fri. 1-4; C, Mon. 9-10 and 3-4, Wed. 2-3 and

Thurs 1-3; D, Thurs. 8-11, Fri. 1-3. Professor Waddell.

VII. SPECIAL QUANTITATIVE ANALYSIS. Magnesium Sulphate, Calcium Carbonate, Cement or Limestone, Steel, Water for industrial purposes.

Course E, Mon. 3-5, Tues. 4-5. Professor Waddell.

VIII. QUANTITATIVE ANALYSIS OF INDUSTRIAL PRODUCTS.

Friday, 8-12. Professor Waddell.

ORGANIC CHEMISTRY.

I. INTRODUCTORY. This subject is treated in a general way in the lectures, and students are required to become familiar with laboratory methods in organic chemistry and to make a few typical compounds.

Lecture—Thurs. 11-12.

Laboratory—Courses B, Wed. 3-5; D, Mon. 3-5. Professor Walker.

Text-books—Moore, *Outlines of Organic Chemistry* (John Wiley and Sons).

Titherley, *Laboratory Course in Organic Chemistry* (Geo. Philip and Son, 32 Fleet St., London, Eng.).

II. INTERMEDIATE. The subject is treated in detail in the lectures, and the typical reactions of the different classes of organic compounds are studied in the laboratory.

Lecture—Wed. 2-3.

Laboratory—Mon. 4-5, Wed. 3-5. Professor Walker.

Text-books—Titherley, *Laboratory Course in Organic Chemistry*.

Norris, *Outlines of Organic Chemistry* (McGraw-Hill Book Co.).

III. ADVANCED. The lectures deal with selected topics of an advanced character. The laboratory work includes quantitative work and preparations of a more difficult character.

Lecture—Tues. 11-12.

Laboratory—Mon. 3-4. Professor Walker.

IV. ANALYSIS OF FOODS AND WATER.

Wed. 1-5. Professor Walker.

V. ADVANCED ORGANIC WORK.

Mon. 9-12, 3-4; Tues. 8-11; Wed. 8-10;

Thurs. 9-10, 1-3. Professor Walker.

PHYSICAL CHEMISTRY.

I. PHYSICAL CHEMISTRY. The various fields of Physical Chemistry, including a brief outline of electro-chemistry are taken up.

Lecture—Fri. 8-9.

Laboratory—Courses B, C, Mon. 11-12, 1-3; D, Mon. 10-12, 1-2. Professor Guttman.

Text-books—Walker, *Introduction to Physical Chemistry* (Macmillan & Co.).

Findlay, *Practical Physical Chemistry* (Longmans, Green & Co.)

II. ELECTRO-CHEMISTRY. The theoretical and practical study of electro-chemistry, special attention being paid to problems of industrial importance.

Lecture—Wed. 10-11.

Laboratory—Tues. 2-5. Professor Guttman.

Text-books—Findlay, *Practical Physical Chemistry* (Longmans, Green & Co.).

Le Blanc, *Electro-Chemistry* (Macmillan & Co.).

Elbs-Hutton, *Electrolytic Preparations*, (Edward Arnold).

III. Practice in the use of the polariscope, spectroscope, microscope, refractometer, etc.

Mon. 9-11. Professors Walker, Guttman and Bonner.

INDUSTRIAL CHEMISTRY.

I. CHEMISTRY OF MANUFACTURING PROCESSES. The course deals with the manufacture of chemicals, industrial products, and the apparatus employed, special attention being given to problems of importance to Canada at the present time.

Lectures—Mon. 3-4, Thurs. 3-4.

Laboratory—Sat. 8-12. Professor Guttman.

Text-book—Thorp, *Outlines of Industrial Chemistry*, (Macmillan & Co.).

II. ENGINEERING CHEMISTRY. A course on engineering chemistry, the subjects dealt with being those of importance to Engineering students, such as the rusting of iron, hard and soft waters, paints, lubricants, explosives and cements.

Lecture—Tues. 1-2. Professor Guttman.

Each student, before entering any practical class, is required to deposit five dollars (\$5.00) with the Secretary. On presenting to the instructor of the class the receipt for this, and the class ticket, the student receives the key of his locker and a set of apparatus. The amount of the deposit is returned at the end of the session, breakages, etc. having been deducted.

GORDON HALL OF CHEMISTRY.

This building, which is entirely devoted to Chemistry, was completed in the autumn of 1911 and is thoroughly modern in every detail. There is on the third floor a large lecture amphitheatre with a seating capacity of 216, on the first floor a small lecture room suitable for advanced classes, and on both the first and third floors a small class room intended for tutorial purposes. There are two

laboratories for general chemistry, one for medical chemistry and one for electrolysis on the third floor; two for quantitative analysis, one for organic chemistry, and two for food and water analysis on the second floor; three for qualitative analysis, one for industrial chemistry, one for physical chemistry, and one for gas analysis and electro-chemistry, on the first floor. In addition to these there are several small laboratories where ample accommodation is provided for research, and for spectroscopic or photographic work. Each member of the permanent staff is provided with a private office and laboratory.

The library of the department of chemistry is situated on the second floor and many of the chemical periodicals of importance both in English and German are kept on file and can be consulted. In addition the library is well provided with modern text-books and works of reference, and there are a few books of historic interest. Students have free access to the library shelves and are allowed to take out books upon application to the attendant in charge.

In the planning of this building special attention has been given to the providing of ample facilities for research and graduate work in both pure and applied chemistry. Students who have obtained the B.Sc. degree will find here all that is necessary to enable them to carry on such advanced work as they may desire.

MINERALOGY.

PROFESSOR—William Nicol, M.A.

ASSISTANT—N. B. Davis, B.Sc.

The work in this department is intended for students taking the courses in (1) Mining and Metallurgical Engineering, (2) Analytical and Applied Chemistry, (3) Mineralogy and Geology, (4) Chemical Engineering, and (5) Civil Engineering.

It consists of six sections, viz.: Mineralogy I, II, III, IV, V and VI.

Students in Course A take sections I and III in the second year, section IV in the third year, and section VI in the fourth year.

Students in Course B take sections I and II in the second year, and sections IV and VI in the third year.

Students in Course C take sections I, II and III in the second year, and sections IV and VI in the third year.

Students in Course D take section I in the second year.

Students in Course E take section V in the fall term of the second year.

MINERALOGY I.

ELEMENTARY MINERALOGY.

The work in this class is intended as a preparation for those entering upon the studies of geology, petrography, mining and metallurgy. The class should be taken in the second session, after the Chemistry and Physics of the first session, as a knowledge of Chemistry and Physics is necessary for a proper comprehension of the subject. The regular work consists of (1) a course of lectures and demonstrations on crystallography at the beginning of the fall term, (2) illustrated lectures on the physical, optical and other properties of minerals, (3) the description of about sixty prominent Canadian minerals, (4) practical work in the determination of these by means of the blowpipe and field tests, (5) excursions on Saturdays of October and November for field work, or in case of unfavorable weather, practical work in the laboratories or museum. Students are urged to make use of the museum in the basement, and of the study room provided for them in the mineralogical department.

Each student is supplied for the session with a locked cabinet and collection of minerals for which he is held responsible, and for which a deposit must be made. The practical work of the class is conducted in the mineralogical blow pipe laboratory, where cabinets containing specimens of commonly occurring minerals are arranged for use. Students are taught to recognize minerals by simple field tests, such as form, colour, streak, hardness, specific gravity, etc. For this work students must provide themselves with pocket-lens, knife, streak-plate and magnet, and must supply their own blowpipe apparatus.

Lecture, Tues. 11-12. Professor Nicol.

Blowpipe Class, Fri. 10-12. Professor Nicol and assistant.

Text-books—Williams *Crystallography* (Henry Holt & Co.).

Miller *Minerals and How They Occur* (Copp. Clark Co.).

Brush & Penfield *Manual of Determinative Mineralogy and Blowpipe Analysis*, 15th Ed., 1906. (Wiley & Sons).

Books for Reference—Crosby *Tables for the Determination of Minerals*.
Eakle *Tables*.

Moses & Parsons *Mineralogy, Crystallography and*
Blowpipe Analysis, 2nd Ed.

Endlich *Manual of Qualitative Blowpipe Analysis*.

Landauer *Blowpipe Analysis*.

Kolbeck 6th Ed. of *Plattner's Probirkunst mit dem*
Löthrohre.

Books from the Department Library and from the Professor's private library may be obtained from the Professor.

MINERALOGY II.

SYSTEMATIC MINERALOGY.

The work of this class is intended for those taking courses B and C, and is preparatory to the work in geology, petrography, and descriptive and determinative mineralogy, which should be taken during the session following.

The regular work consists of a course of lectures, three hours per week, dealing with the physical and other properties of minerals, illustrated by specimens from the lecture cabinet, microscopic slides, thin sections, models, charts and lantern slides. Essays on prescribed subjects are required.

Lectures—Mon. 8-9, Wed. 9-10, and one hour to be arranged with class; first term. Professor Nicol.

Text-books—Dana *Text-book of Mineralogy*, 1909. (Wiley & Sons).

Williams *Crystallography*. (Henry Holt & Co.).

Books for Reference—Miers *Mineralogy*.

Tschermak *Mineralogie*.

Brauns *Mineralreich*.

MINERALOGY III.

OPTICAL MINERALOGY.

The work of this class is intended for those students only, who are taking Course A, Mining Engineering, Course B, Analytical and Applied Chemistry, and Course C, Mineralogy and Geology. It is preparatory to the classes of petrography and determinative mineralogy, which should be taken during the session following. The lectures treat of light and the optical properties of minerals. Reflection, diffusion, refraction, dispersion, polarization, absorption, color, etc., are described and illustrated by the use of the lantern and projection apparatus.

Lectures—Mon. 11-12, Thurs. 11-12, second term. Professor Nicol.

Text-Book—Dana *Text-book of Mineralogy*, 1909. (Wiley & Sons).

MINERALOGY IV.

DESCRIPTIVE AND DETERMINATIVE MINERALOGY.

Before taking this class students in Course A must have passed in Mineralogy I and III, and students in Course B in Mineralogy I and II, and students in Course C, in Mineralogy I, II and III. It should be taken along with the classes of petrography, economic geology and metallurgy in the third year.

The work of this class consists in the exhibition and description of the mineral specimens contained in the several museum collections, special attention being given to ores, gangue-minerals, those having a commercial value and those of importance as rock-forming minerals in geology. By field tests and the use of the blowpipe, practice is obtained in the determination of minerals. Cabinets furnished with specimens of minerals from various parts of the world are supplied for students' use. The number of specimens is being constantly increased by collection, donation, exchange and purchase, the aim being to make the collection as complete as possible.

Laboratory—Courses B, C, Thurs. 3-4; A, B, C, Tues. 8-9, 1-3, Wed. 1-2.

Text-Books—Dana *Text-book of Mineralogy*, 1909. (Wiley & Sons).

Brush & Penfield *Manual of Determinative Mineralogy and Blowpipe Analysis*, 15th Ed., 1906. (Wiley & Sons).

MINERALOGY V.

PREPARATORY MINERALOGY.

The work of this class is intended for students taking the course in Civil Engineering—Course E—and for those who attend the class of Geology I, without any previous knowledge of mineralogy.

The work consists of a course of about a dozen practical demonstrations, one hour per week during the fall term, to make students familiar with the more common rock-forming minerals and ores, so that the geology lectures may be more intelligible. The students are taught to recognize minerals by field-tests, such as form, colour, lustre, streak, hardness, specific gravity, etc.

Lecture—Wed. 11-12.

The attention of students is called to the collection of minerals on exhibition in the students' study, and to the several collections in the museum in the basement. Students in this class should attend the Saturday excursions.

Text-Book—Miller *Minerals and How They Occur*.

MINERALOGY VI.

ECONOMIC MINERALOGY.

A course of lectures, illustrated by specimens and lantern slides, supplemented by demonstrations in the museum showing the occurrence and uses of minerals.

The following minerals and mineral substances will be discussed: Gold, Petroleum, Asphalt, Graphite, Diamond, Antimony and Ores, Arsenic, Tin, Corundum, and Carborundum, Portland Cement, Limestone, Feldspar and Kaolin, Talc, Asbestos, Phosphates, Gypsum, Nitre and Borax, the rare earths, the gem minerals, ruby, quartz, etc.

Lecture—Thurs. 8-9. Professor Nicol.

FIELD CLASSES IN GEOLOGY AND PROSPECTING.

The attention of students and others is called to the practical study of geology, mineralogy, and prospecting methods. Some of the chief mineral localities of the Kingston district are visited each session and abundant opportunities are offered for collecting specimens and studying the modes of occurrence of substances of economic value. These excursions are compulsory for all students in mineralogy and geology after the first year. The cost will not exceed \$5.00.

GEOLOGY.

PROFESSOR—M. B. Baker, B.A., B.Sc., F.G.S.A.

ASSISTANT PROFESSOR—Jesse E. Hyde, M.A.

In selecting the site for a School of Mining, the Government of Ontario was strongly influenced by the unique situation of Kingston. It has been stated by an eminent Canadian geologist that with the possible exception of Freiberg, in Germany, no school is so well situated for the teaching of Geology as is the Kingston School of Mining. Geology is the study that investigates the history of the Earth and its inhabitants. Within a half hour's walk of the college the old Laurentian Hills, the back-bone of Canada, are exposed, and lying about their old eroded and disintegrated flanks is the first volume of the geological record from which the Earth's history is to be read. Students are therefore conducted regularly into Nature's museum where geological processes have been at work so long that their results are unmistakably clear.

Within one hundred miles of Kingston there is a greater variety of economic minerals and ores mined than in any other similar area in Canada and possibly in the world. Through the kindness of the

managers, these properties are visited by the advanced students and are of inestimable value to them in forming an idea of economic geology and mining engineering.

The Geological and Mineralogical Museum situated on the ground floor of the Ontario Hall is equipped with splendid collections of minerals, ores, rocks, and fossils, classified and systematically arranged to illustrate most of the subjects treated of in lectures. This is a section of the work in which the co-operation of the mining public is invited, and all donations to this museum will be kept and credited to the donor.

The various courses in Geology described in some detail below, are intended to equip the professional geologist, the mining engineer, the civil engineer requiring a knowledge of the relative merits of natural construction material, and the student who does not expect to use the knowledge professionally, but as one of the broadest studies he can take up from a purely educational standpoint. The classes are, therefore, open to Arts students as well as to those of the engineering professions. Graduates or others wishing to investigate a special geological problem will have all possible facilities in the way of laboratories and apparatus at their disposal.

GEOLOGY I.

ELEMENTARY GEOLOGY.

Students taking this class must have passed in Chemistry I. They are also required to take Mineralogy I or Mineralogy V.

In this class an introductory course in general Geology is given, including an elementary course in stratigraphical Geology and Paleontology. It is, therefore, a preparatory course for those students who proceed to a more advanced course in Geology or Mining, and is at the same time a more or less complete, though elementary, course in Geology for those who do not pursue the subject any farther.

The following subjects will be treated of in the lectures:—The Planetary Relations of the Earth; the Atmosphere; the Hydrosphere; the Lithosphere; the probable nature of the Earth's interior; the general characters and classifications of rocks; volcanic action; earthquakes; upheaval and subsidance; the Geological effects produced by heat, air, water, and life; bosses; dykes; veins; stratification; dip and strike; anticline and syncline; faults; foliation; the nature and uses of fossils; stratigraphical Geology, and an outline of the history of the Earth including the evolution of its plant and animal life.

The lectures are illustrated by maps, diagrams, and lantern slides. Laboratory work will consist of the examination of typical specimens of the different groups of fossil plants and animals, and of hand specimens of the more common rocks.

During the months of October and November excursions will be conducted each Saturday to places of geological interest in the vicinity of Kingston. Students in Geology and Mineralogy are required to take part in these excursions. The cost will not exceed \$5.00. Each student should provide himself with a suitable hammer, specimen bag, and notebook.

Lectures—Tues. 9-10, Thurs. 2-3. Professor Hyde.

Text-Book—W. B. Scott, *An Introduction to Geology*.

GEOLOGY II.

GENERAL GEOLOGY.

Before taking this class, students must have passed Geology I.

First term: The origin of the Earth and the principles of crustal movements, deformation, faulting, mountain formation, metamorphism and vulcanism are covered in a more general and a more advanced way than in Geology I. This part of the course is required of students taking courses A and C.

Second term: Advanced consideration of surface processes, the action of winds, streams, waves, glaciers, etc.; various types of marine and continental sedimentation; and the development of land forms. This course is required of the students taking course C.

Lectures—Wed. 10-11, first term; Mon. and Fri. 10-11, second term.
Professor Hyde.

Text-Book—Chamberlain & Salisbury, *College Geology*.

Books for Reference:

Chamberlin & Salisbury, *Geology*, Vol. I.
VanHise, *A Treatise on Metamorphism*.
Clark, *The Data of Geochemistry*.
Harker, *The Natural History of Igneous Rocks*.
Davis, *Physical Geography*.
National Geographic Society, *Monographs*.
Assigned Readings.

GEOLOGY III.

ELEMENTARY PETROGRAPHY.

Students must have passed in Geology I, and in Mineralogy II and III.

This course is essentially on igneous geology and petrography, and will consist of lectures on the use of the petrographical microscope and accessories in the determination of rock forming minerals, and on the determination of some of the more common igneous rocks by both microscopic and field tests. This will be followed by lectures and discussion on the geological occurrences of igneous rocks, the processes of crystalization from magmas, the forms assumed, the textures, and the metamorphic changes that are produced in the mass itself and on its surroundings. The lectures will be illustrated by means of projections of thin sections of rocks, and will be supplemented by laboratory work on hand specimens and rock slides.

Lectures—Tues. and Thurs. 10-11. Professor Baker.

Laboratory class two hours per week, in sections, *Mon. 1-3, or 3-5; or Tues. 1-3.* Professor Hyde.

Text-books:

Pirsson, *Rocks and Rock Minerals.*

Luquer, *Minerals in Rock Sections.*

GEOLOGY IV.

MINING GEOLOGY.

Before taking this class students must have passed in Geology I.

A course of lectures will be given on the genesis of ore deposits, their modes of occurrence, classification, and secondary enrichment. The subject of 'croppings' or gossan formation will be discussed, also the faulting and other disturbances of ore deposits, the tracing of the faulted portions, the surface and underground evidences of faulting, etc. During the term excursions will be made to various mines in the vicinity of Kingston.

Lectures—Mon. and Fri. 10-11. First term, Professor Baker.

Text-Book—Spurr, *Geology Applied to Mining.*

Books for Reference:

Kemp, *Ore Deposits of the United States and Canada.*

Phillips & Louis, *A Treatise on Ore Deposits.*

Beck, Trans. by Weed, *The Nature of Ore Deposits.*

Proc. A.I.M.E., *Origin of Ore Deposits.*

Rothwell, *The Mineral Industry.*

GEOLOGY V.

GEOLOGY OF CANADA.

Before taking this class students must have passed in Geology I.

In this course special attention will be given to Stratigraphical Geology, and the distribution of the various rock formations in Canada. The topography as well as the structural make-up of the Dominion is studied. The climatic and economic differences of the various portions of Canada are explained.

Lecture—Wed. 10-11. Second term, Professor Baker.

Books for Reference:

Brock & Young, *Geology and Economic Minerals of Canada*.
Dawson, *Geology of Canada*.
Chapman, *Minerals and Geology of Ontario and Quebec*.
Geological Survey of Canada Reports.
Reports of the various Provincial Bureaus of Mines.

GEOLOGY VI.

HISTORICAL GEOLOGY.

After a brief study of the various types of sedimentary formations and the principles of Paleogeography, the history of the North American continent is taken up. A number of the more important fossils of each period are studied, and their recognition on sight required. Brief consideration is also given to the history of the Science of Geology.

Lectures—Mon. and Thurs. 11-12. Professor Hyde.

Books for Reference:

Schuchert, *Paleogeography of North America*.
Chamberlin & Salisbury, *Geology*, Vols. 2 and 3.
Dana, *Manual of Geology*.
Graubau and Schimer, *North American Index Fossils*.
Zittel, *Text-Book of Paleontology*.
Various Authors, *Outlines of Geologic History*.
Geikie, *Founders of Geology*.
Zittel, *History of Geology*.

GEOLOGY VII.

ADVANCED PETROGRAPHY.

A course of lectures will be given on the microscopic characters and classifications of igneous rocks, and on their general field characters, origin and classification. The lecture work will be supplemented by assigned special reading and by laboratory work with both hand specimens and microscopic slides. Special attention will also be paid to the metamorphic rocks.

Lecture—Fri. 11-12. Professor Baker.

Books for Reference:

Harker, *The Natural History of Igneous Rocks.*

Kemp, *Hand Book of Rocks.*

Iddings, *The Origin of Igneous Rocks.*

Iddings, Weed, Pirrson, Washington, *Classification of Igneous Rocks.*

Rosenbusch-Iddings, *Microscopical Physiography of Rock-forming Minerals.*

Rosenbusch, *Die Massige Gesteine, Element der Gesteinslehre.*

Laboratory class two hours per week, to be arranged to suit students' time-table.

GEOLOGY VIII.

ECONOMIC GEOLOGY.

The work in this class is supplementary to that in Geology IV, and is an illustration of the principles of ore deposition studied in that class. For this purpose type deposits in the largest producing districts throughout the world are studied in some detail. It is, of course, impossible to treat of all products, but the basis of classification and the fundamental principles underlying economic deposits are studied with particular reference to iron, copper, nickel, zinc, lead, silver, gold, aluminum, peat, coal, gas, oil, salt, abrasive and refractory materials. A few lectures on building stone as well as on clays and the manufacture of clay products will be given.

Lecture—Mon. 3-4, Tues. 11-12. Professor Baker.

Books for Reference:

Williams, *Applied Geology.*

Ries, *Economic Geology of the United States.*

Beck, Trans. by Weed, *Nature of Ore Deposits.*

Kemp, *Ore Deposits of the United States and Canada.*

Merrill, *The Non-metallic Minerals.*

Hancock, *Notes on Applied Geology.*

Mineral Statistics of the Geological Survey U.S. and Canada.

GEOLOGY IX.

This course is intended for students in Civil Engineering.

The occurrence, composition, texture, structure, and alteration of rocks will be considered, with special reference to their effects on the workability or removal of the rocks in excavation work, and in the selection of raw material in construction work. There will also be lectures on clay-products and the selection of building materials, and an outline of the manufacture of bricks,

fire-proof blocks, terra-cotta, roofing-tile, sewer-pipe, and drainage-tile, will be given. Physiography and drainage will also be studied, and a brief summary of the Geology of Canada will be made.

Lecture—Thurs. 9-10. First term, Professor Baker.

Books for Reference:

Merrill, *Rocks, Rock Weathering, and Soils.*

Merrill, *Stone for Building and Decoration.*

Howe, *The Geology of Building Stone.*

Watson, *Building Stones.*

Searle, *The Clay-Workers' Hand-book.*

GEOLOGY X.

FIELD AND LABORATORY GEOLOGY.

The laboratory exercises in this course are designed to illustrate by means of specimens, models, photographs, maps and sections, the principal original and secondary structures of rocks; the origin and mode of occurrence of rocks in the Earth's crust; their cycles of alteration and change; their interpretation and representation in Geological Surveys.

The field work comprises observations upon the weathering of rocks, shore phenomena, glacial phenomena, igneous and sedimentary rocks, faulting, folds, joints, cleavage, schistosity. Practice in methods of surveying and geological mapping and construction of sections; measuring the thickness of strata and determining the relative ages of geological structures, and the preparation of a map to scale.

Two working hours per week will be arranged to suit the class at the beginning of the first term.

BOTANY.

PROFESSOR—W. T. MacClement, M.A., D.Sc.

Students in the Science courses requiring work in Botany are given such portions of the Pass and Honour courses as will be most valuable to them.

For Palacontology, the Morphology and Anatomy of Bryophytes, Pteridophytes and Spermatophytes is required.

For Sanitary Engineering, the morphology of Algae and Fungi, including Bacteria, is important.

For Mechanical and Structural Engineering, the anatomy of the woods chiefly used for engineering purposes, and the fungi associated with their destruction, are discussed and drawn.

All students get an outline of Forest Conservation.

Laboratory—Mon., Wed., Fri., 1-4. First term.

Text-books :

Coulter, Barnes, and Cowles, *Text-book of Botany*, Vol. I.

Stevens, *Plant Anatomy*.

Reference Books :

Frost and McCampbell, *General Bacteriology*.

Massee, *Diseases of Economic Plants and Trees*.

Ward, *Timber and its Diseases*.

ANIMAL BIOLOGY.

PROFESSOR—A. P. Knight, M.A., M.D.

LECTURER—G. E. Kidd, B.A., M.D., C.M.

LECTURER—A. B. Klugh, M.A.

DEMONSTRATOR—Thomas Little.

Arts students must take parts I and II. Students in the Mining School need take Part II only.

The Arts class occupies three hours a week for the whole session. Part I will extend from October until Christmas and will treat of general biology and the every-day lives of animals.

Part II will deal with the outlines of classification and will extend from the Christmas holidays until the close of class work in April. It will be suitable for students taking the honour course in geology or the course in mining engineering.

Lectures or demonstrations tri-weekly, 9-10. Professor Knight.

Text-book for Mining School Students—Kingsley, *Comparative Zoology*.

MINING ENGINEERING.

PROFESSOR—J. C. Gwillim, B.Sc.

LECTURER—C. W. Drury, B.Sc., A.M.

Under this heading are placed the subjects, Mining I, Mining II, and Ore Dressing.

Mining I and Ore Dressing are taken by third year students in Mining and Metallurgy ; Mining II by students of the fourth year.

Students in Course C (Mineralogy and Geology) take Ore Dressing in their third year ; and Mining I in their fourth year.

The subjects of Mining and Metallurgy IV or (Metallurgy, Mining and Mill Designing) are taken up practically, by all fourth year students in the Mining and Metallurgical Engineering course. A Summer Essay, compiled from field observations, is also required.

MINING I.

ORE DEPOSITS. Conditions which produce and indicate them; their nature and origin; their affinity with certain conditions and rocks, and their classification. These lectures are supplementary to the study of economic geology.

PROSPECTING. Methods used in prospecting for lode, placer and coal mines. Location, laws, and requirements, of mineral prospects and their examination.

DEVELOPMENT OF PROSPECTS. The early workings of mines, with a consideration of the many factors entering into the proving up of mineral bodies as commercial quantities.

BORING. The use of long distance drills for prospecting, and for reaching fluids. The rotary diamond drill, and the percussion drills; their fields of operation and relative merits.

EXCAVATION. The tools and machines used in breaking and removing rocks. Also hand and power drilling to place explosives. The common mining explosives; their uses and operation.

MINING METHODS. A consideration of the main factors in developing a mine. The sinking of shafts; driving of tunnels, etc. The stoping or winning of minerals from the vein or ore body.

Lectures Tues. 9-10(b), Wed. 11-12, Fri. 8-9(a). Professor Gwillim.

ORE DRESSING.

These lectures follow quite closely the subject as taken up in Richards' Text-book of Ore Dressing. They follow the sequence of operations from the arrival of crude ore or mill-rock at the mill until it leaves as a concentrate or bullion. Miscellaneous processes such as magnetic separation, oil, flotation and air processes, and coal washing, are taken up separately.

The chief features of this subject are to teach the principles and operations of rock crushing and grinding. Stamp milling with amalgamation, screening and sizing of crushed ore, classification of sands and slime by water, as a preparation for the separation of minerals by jigs, tables, and other devices of proved efficiency.

Lectures—Mon. 8-9, Thurs. 11-12. Professor Gwillim and Mr. Drury.

Books of Reference:

Richards, *Text-book on Ore Dressing*.

Louis, *The Dressing of Minerals*.

MINING II.

PLACER MINING. Consideration of alluvial deposits and their origin: placer mining proper, hydraulic placer, and gold dredging.

SUPPORTS. Various forms of timbering or supporting a mine's passages, and stope excavations. The timbers used. Costs and alternative methods; causes of decay in timbers and their preservation. The use of iron and masonry.

TRANSPORTATION. The handling of material underground, by chutes, cars, and hoists; rope and locomotive haulage. Surface transportation by road, rope, and railway. Loading, unloading, and terminal arrangements.

HOISTING. Head frames, ropes, and drums; various systems which balance the load to some extent or give a steady load on the engines. Hoisting of ore. Safety appliances and signalling.

DRAINAGE. Sources of water, drainage by tunnels; hoisting of water; use of pumps, and principal types for light and heavy work. Bulkheads.

VENTILATION. Natural and artificial conditions which demand ventilation. Methods of ventilating metal and coal mines. Gases of a coal mine. Fans, and distribution of air in coal mines.

LIGHTING. Use and place of candles, lamps, and safety lamps.

ACCIDENTS. PRINCIPLES OF EMPLOYMENT.

MINE EXAMINATION AND VALUATION.

STUDENTS' PAPERS. These are hour or half hour talks upon observations from experience in the field.

Lectures—Mon. 10-11, Wed. 9-10, Thurs. 2-3. Professor Gwillim.

Books of Reference:

- (1) C. LeNeve Foster, *Ore and Stone Mining*.
- (2) Ihlseng, *Mining Manual*.
- (3) *The Coal and Metal Miners' Pocket-book*.
- (4) H. W. Hughes, *Coal Mining*.
- (5) *Current Mining Journals, etc.*

MINING AND METALLURGY IV.

This practical work includes four weeks furnace and metallurgical work, and the plotting of mine surveys, for five hours a week during the first term.

In the second term the student may choose any subject suitable to the course, as a subject for designing, for example, the designing of a mill, smelter, surface plant of a mine, or equipment to illustrate the summer essay.

Tues. 2-4, Wed. 1-4. Professors Gwillim and S. F. Kirkpatrick.

SUMMER ESSAY.

In order to encourage close observation, and the faculty of expressing by text and illustration, the student during his summer vacations is expected to gather material for an essay of from two to three thousand words.

Such an essay neatly presented with sketches or illustrations may be included as part of the work in Mining and Metallurgy IV.

The subject title must be given in by the end of the first term of the final year, and the essay handed in before the end of the second term.

THE MINING AND METALLURGICAL LABORATORIES.

These are equipped for the testing of ores in small lots from various mining districts.

The machinery used is in most cases of standard sizes and the ores treated of sufficient quantities to give results which are about the same as commercial practice would give. The uses of the Mill and Laboratories are to furnish training and illustration, to experiment with various processes, and to give help at very reasonable rates to those who are seeking some method of treatment. The ores received are sufficient in quantity and variety to illustrate most of the usual methods of treatment found in actual practice. The work is divided into three main portions.

(1) Stamp Milling, Cyanidation, Chlorination and other Metallurgical processes in the first term.

(2) Concentration processes in the second term.

(3) In the Metallurgical Laboratory small quantities of ores are treated by smelting in blast or reverberatory furnaces, and experiments are conducted on the refining of metals, such as lead and copper; on the determination of the properties of iron and steel; and in connection with pyrometry, and the operation of the electric furnace.

Fri. 8-4, Sat. 8-12.

The equipment of the mill as it stands at present consists of the following:—10 in. by 7 in. Blake jaw crusher; 16 in. crushing rolls; 5 stamp battery, 850 lbs., stamps with automatic feeder; 10 in. cone grinder; No. 0 Krupp Ball Mill; impact screen; inlet discharge classifier; vertical line classifier; U-tube classifier for slimes; perforated board classifier for slimes; cone classifier and glass tube classifiers; 3 compartment spitzkasten; 3 compartment Hartz jig; 2 compartment Evans high-speed jig; 1 Vezin jig; 4 ft. Frue Vanner; Wilfley table (riffle washer); 16 ft. modern Evans buddle; Wetherell magnetic concentrator; Ball-Norton magnetic separator; Kingston magnetic separator, dry or wet; Behrend dry concentrator; Sturtevant exhauster and blower; Heald and Sisco centrifugal pump; Frenier and Sons' spiral sand pump; Cazin water-motor; Northey mine pump; centrifugal machine for slime treatment; Johnston filter press for slime treatment; Ingersoll-Sergeant rock drill; Mac Machine Company's balanced valve rock drill; Rand rock drill; tripods for rock drill; drifting column for rock drill; Jackson's hand power rock drill; barrel chlorination plant; cyanide plant (1,000 pounds capacity); reverberatory roasting furnaces, small oil fired reverberatory, gas muffle furnace, soft metal furnace, electric furnace; No. 3 Reichhelm blower; 2 H.P., 4 H.P., 6 H.P. and 25 H.P. electric motors.

NICOL HALL.

Nicol Hall, the latest addition to the buildings on the campus, is equipped for the accommodation of the Mining and Metallurgy Department.

In the rear of the basement there is a sampling room with power and hand grinding devices for preparing the necessary samples for the assay laboratories.

The greater part of the eastern half of the basement is devoted to fire assaying. These laboratories are equipped with fluxing and balance tables, gasoline crucible furnace, gasoline, gas, and oil muffle furnaces, and accessory apparatus.

A separate balance room is fitted with assay and chemical balances to be used in connection with this fire assaying and the chemical work carried out in the two front rooms. The latter

laboratories will accommodate the final year students in Mining and Metallurgy and be used in conjunction with the Milling and Metallurgical laboratory work.

A small room in front is fitted for electrolytic assaying.

The western half of the basement is devoted to Metallurgical laboratories and is equipped with electric furnaces, blast furnaces, roasting furnaces, etc., and with sufficient power for extended research work.

The Metallurgy lecture room, second research laboratory, cloak-rooms, etc., are on the first floor; and the Mining lecture room, draughting room and students' library on the second floor.

METALLURGY.

PROFESSOR—S. F. Kirkpatrick, M.Sc.

LECTURER—C. W. Drury, M.A.

METALLURGY I.

A thorough drilling in fuels, the special metallurgical uses of each kind, determination of calorific power, experimentally and by calculation from composition, calorific intensity and methods of pyrometry, charcoal manufacture, coals, coke, coking methods, producer gas and its manufacture in modern approved appliances, liquid fuels, etc. This is followed by a brief discussion of the physical properties and uses of the common metals. During the second term special attention is given to the study of the properties of iron and steel and the effect of the method of manufacture on these properties.

Lectures—Tues. 11-12, Wed. 8-9. Professor Kirkpatrick.

METALLURGY II.

Hydro-metallurgy of gold and silver.

Milling and amalgamation of gold and silver ores.

Metallurgy of copper, including treatment of native copper and sulphide ores by concentration and smelting, reverberatory and blast furnace matting, pyritic smelting, refining, and hydro-metallurgy.

Metallurgy of lead, including reverberatory and blast furnace practice, softening, desilverising, etc.

Metallurgy of iron and steel, including preparation of the ore for smelting, production of pig iron in the blast furnace, conversion into wrought iron

in the puddling furnace, manufacture of steel by the crucible, Bessemer and open-hearth processes.

Also the consideration of the ordinary methods of recovering zinc, nickel, cobalt, tin, mercury, arsenic, antimony, etc., from the ores.

One hour each week will be devoted to examinations and the discussion of metallurgical subjects by the students.

Lecture and recitation—Mon. 9-10, Tues. 9-10, Wed. 11-12, Thurs. 9-10
Professor Kirkpatrick.

METALLURGY III.

Electro-metallurgy; introductory course in electro-chemistry followed by the consideration of the electric smelting of aluminium, copper, magnesium, iron, etc.

Lecture—Thurs. 2-3 (b). Professor Kirkpatrick.

FIRE ASSAYING.

Quantitative determination of gold, silver and lead in ores and bullion by fire assay.

Laboratory—Sat. 8-12. Second term, Mr. Drury.

RESEARCH LABORATORIES OF APPLIED ELECTRO-CHEMISTRY AND METALLURGY.

PROFESSOR—H. T. Kalmus, S.B., Ph.D., Director of Laboratories.

RESEARCH ASSOCIATE—C. Harper, B.A.

RESEARCH ASSOCIATE—W. L. Savell, B.Sc.

RESEARCH ASSISTANT—R. C. Wilcox, Ph.G.

RESEARCH ASSISTANT—G. Hyland.

One of Canada's greatest sources of natural wealth is her mineral deposits. In Ontario alone are found the metals gold, silver, iron, copper, nickel, cobalt, lead and zinc, with a tremendous variety of non-metallic substances. In some instances Canada is the sole source of supply for the whole world. The efficient economical development of these vast resources, with proper observance of the principles of conservation, is one of the great problems of to-day.

Proper development in this respect involves not only that new ways be found to increase the efficiency and economy of production and utilization of materials which are of known value, but it requires that adequate uses be found for the by-products of these processes, as well as for the great masses of material which up to the present time have been temporarily set aside in the rush for the obviously valuable. That means scientific and industrial investigation and research. This in part is performed at the laboratories of the industrial concerns most directly interested in the advances, but the largest problems, often involving the welfare of every citizen, are undertaken unsuccessfully or not at all by those in charge of these industries. Such general problems can be attacked best by the people's institutions,—their government bureaus and their universities. Much of it can be done best by the co-operation of the two.

Consequently the Mines Branch, Canada Department of Mines, and the School of Mining, have co-operated in this way by establishing laboratories of Applied Electro-Chemistry and Metallurgy at Queen's University, which have been in active operation since April, 1912. A considerable portion of the new Nicol Building is devoted to this department and has been equipped for special researches. Also, the very complete equipment of the Department of Metallurgy in the same building, and of other departments in related branches throughout the School of Mining, are available for use in the prosecution of these researches.

The University recognizes that it is not only its function to lend its professors and its laboratories to research work, but it is its duty to train some of its students to take up and carry on research of this type, not alone for the investigations themselves, but to meet the increasing demand for men thus trained.

The research laboratories are operated throughout the entire year, and afford summer employment to a limited number of competent students. In this way an invaluable training will be given to certain students interested in applied electro-chemistry or metallurgy, and in research. It is expected that certain advanced students will find it to their advantage to spend a year or so engaged in research work of the kind afforded by these laboratories.

CHEMICAL ENGINEERING.

ASSISTANT PROFESSOR—Leo F. Guttman, A.C.G.I., Ph.D., F.I.C.

CHEMICAL ENGINEERING I.

INDUSTRIAL PROCESSES.

The chemistry of various important chemical manufactures is studied in detail, and its influence discussed on the design and construction of the manufacturing plant. The newest applications of electric power in the manufacture of caustic soda, fertilisers, and explosives are studied and discussed.

DESIGNING OF CHEMICAL PLANT.

Calculations and exercises in designing chemical apparatus and factories. Considerations underlying the choice of materials of construction. The design of a nitric acid plant. The general design of a sulphuric acid works. The design of a chemical plant based on experimental results worked out in the laboratory.

Lectures—Tues. 10-11, Wed. 9-10, Thurs. 10-11. Professor Guttman

CHEMICAL ENGINEERING II.

LABORATORY WORK AND DRAWING.

Technical methods of analysis, including rapid methods, and those involving the use of special apparatus and conditions.

The elaboration of the best working conditions for a given chemical process in the laboratory.

The designing and drawing of parts of a chemical plant based on laboratory results.

The practical work will be divided between the laboratory and the draughting room as is found necessary.

Laboratory and draughting room—Tues. 11-12, 1-2; Thurs. 8-9, 1-3; Fri. 10-12; Sat. 8-12, first term.

LABORATORY OF CHEMICAL ENGINEERING.

The laboratory is provided with large size models of a ball mill, of steam-jacketed evaporating pans, both plain and porcelain lined and fitted with stirring gear, with a steam-jacketed vacuum evaporating apparatus, with a small high pressure filter, with several types of vacuum filters, and with a small crucible blast furnace.

There are further installed a large reaction tower of earthenware designed for experimental purposes, connected to an adjustable fan and ventilating flues, and provided with a liquor circulating system and with selected types of earthenware filling material.

A portable electro-motor is available for power purposes, as well as electric current up to 75 amperes at 17 volts, and 5 kilowatt at 110 volts.

There are also installed balances for the rapid weighing of small and large quantities, together with various types of special analytical apparatus.

The instruction in this laboratory is planned to accustom the student to handle fairly large quantities of materials and to become familiar with standard types of technical chemical apparatus; as well as to work out the experimental methods required for attacking a practical problem, and to translate the laboratory results obtained into practice.

THERMODYNAMICS.

PROFESSOR—F. O. Willhafft, M.E., A.M.

ASSISTANT—C. W. Burroughs, B.Sc.

THERMODYNAMICS I.

Fundamental laws of Thermodynamics. Behaviour of gases under varying conditions. Theory of air compressors and air motors. Transmission of power by compressed air. Properties of steam and elementary theory of the steam engine. Thermal and mechanical efficiency of heat engines. Operation of simple valves and governors. Measurement of power. Elementary theory of gas engines.

Lectures—Tues. and Fri. 9-10 (a). Professor Willhafft and Mr. Burroughs.

THERMODYNAMICS II.

Continuation of I.

Lecture—Tues. 9-10. Professor Willhafft.

THERMODYNAMICS III.

Theory of refrigerating machines and systems. Entropy and entropy-temperature diagrams. Superheated steam. Performance of actual engines. Influence of size, speed, valve gear and ratio of expansion on economy. Steam jackets. Compound and triple expansion engines. Advanced theory of gas and oil engines. Action of steam upon turbine buckets. Flow of steam through nozzles, orifices, and turbine passages. Effects of friction on flow. Types of steam turbines, and their operation.

Experiments in Thermodynamic Laboratory.

Lectures—Tues. 11-12, Thurs. 9-10.

Laboratory—Sat. 8-12 (a). Professor Willhafft and Mr. Burroughs.

THERMODYNAMICS IV.

Advanced Laboratory work for Mechanical Engineering students.

Laboratory—Fri. 9-12, 1-4. Professor Willhafft and Mr. Burroughs.

THERMODYNAMICS V.

Simple laboratory experiments for third year Mechanical Engineering students.

Laboratory—Wed. 2-5. Professor Willhafft and Mr. Burroughs.

THERMODYNAMICS LABORATORY.

The equipment of this laboratory includes an air compressor, gas engine and gas producer, gasoline engines, kerosene engine, centrifugal fans, centrifugal pumps, reciprocating pumps, steam engines, condensers, calorimeters, and dynamometers, together with all the auxiliary apparatus required for making tests and carrying on experimental work. All apparatus is of standard type and latest design.

A considerable part of the practical work in Thermodynamics is done in connection with the central heating and power plant, which affords exceptional advantages for carrying on experimental work, having been designed with due regard to this purpose.

Every year extensive tests are undertaken of commercial power plants located in Kingston and vicinity, and it is believed that this is a specially valuable feature of the course.

GENERAL ENGINEERING.

PROFESSOR—Alexander Macphail, B.Sc.

This subject embraces the physical properties of materials used in the different branches of engineering and the principles involved in the theory of beams, columns, and structures.

GENERAL ENGINEERING I.

MATERIALS OF CONSTRUCTION.

Lectures comprise: Strength and quality of timber, stone, brick, cement, mortar, and concrete; physical properties of the metals and alloys used in engineering, and effects of impurities in them; testing for tensile, compressive and transverse strength.

MECHANICS OF MATERIALS.

Resistance and elasticity of materials; theory and design of simple and cantilever beams; pipes, cylinders, and riveted joints; analytical determination of stresses in simple framed structures; dead and live loads; centres of gravity; moments of inertia; shearing force and bending moments.

GRAPHICAL STATICS.

Graphical representation of stresses in simple framed structures; graphical determination of centres of gravity; shearing forces and bending moments.

Lectures—Mon. 11-12, Thurs. 9-10. Professor Macphail.

Books of Reference:

Merriman, *Mechanics of Materials.*

Merriman, *Strength of Materials.*

Thurston, *Materials of Construction.*

Merriman, *Roofs and Bridges, Part II.*

Slocum & Hancock, *Strength of Materials.*

GENERAL ENGINEERING II.

MECHANICS OF MATERIALS.

Analysis of restrained and continuous beams and columns; torsion of shafts; combined stresses; flexure of beams and theorem of three moments; plate and lattice girders and columns; resilience and fatigue of materials; initial and temperature stresses; earthworks, retaining walls and dams; arches and arched ribs; suspension bridges.

GRAPHICAL STATICS.

Graphical determination of stresses in roof trusses, bridges, cranes, earthworks, retaining walls, dams, arches, arched ribs, cantilever and suspension bridges.

THEORY OF STRUCTURES.

Girders, roofs and bridges; selection of types with reference to span, loading, head-room, cost, aesthetic design and other considerations; relative advantages of riveted and pin connections; wind bracing and stiffening trusses; trestles and towers.

Lectures—Mon. 2-3, Wed. 10-11. Professor Macphail.

Text-book:—Slocum & Hancock, *Strength of Materials.*

Books of Reference:

Bovey, *Theory of Structures.*

Merriman, *Mechanics of Materials.*

Merriman, *Roofs and Bridges, Part I, II, III.*

GENERAL ENGINEERING III.

This course consists of practical work in the draughting rooms, mechanical, electrical, and testing laboratories. Its object is to give the student a knowledge of the practical application of the fundamental principles of engineering in general.

Routine tests of cement, lime, mortar, brick, stone, timber, iron, steel, etc. Specific gravity, fineness, tensile and compressive, strength of cement, etc.

Measurement of mechanical power by means of indicators, dynamometers, etc. Simple experiments in thermodynamic laboratory.

Measurement of electrical power. Simple tests of motors and generators. General electrical measurements.

Laboratory and Draughting Room—Thurs. 1-3. Professor Macphail,
Professor Gill Professor Willhofft.

GENERAL ENGINEERING IV.

This course is for Civil Engineering students of the fourth year, and consists of independent work in the testing laboratories.

GENERAL ENGINEERING V.

Lectures in this course comprise the care, handling, storing, qualities and use of the various explosives used in Engineering works.

Lecture—Wed. 9-10. Professor A. K. Kirkpatrick.

GENERAL ENGINEERING VI.

For students in Civil Engineering, third year only.

GRAPHICAL REPRESENTATION.

Representation of mathematical functions, engineering formulae and data. Progress and cost diagrams, and graphical solution of equations, interpretation of diagrams, solution of problems by means of diagrams. The Elements of Graphical Statics.

Lecture—Wed. 11-12. Professor Malcolm.

GRAPHICAL STATICS.

Continuation of work in General Engineering II. Practical work in drafting room.

Sat. 9-12. Second term, Professor Macphail.

ENGINEERING FIELD WORK.

PROFESSORS—A. K. Kirkpatrick; Alexander Macphail, B.Sc.

The classes in this subject are practical, and enable students to become perfectly familiar with the instruments and take charge of the different departments of Surveying work.

ENGINEERING FIELD WORK I.

will be present at the School of Mining, at 10 a.m., on the day preceding the Spring Convocation, 1914, to commence Field Work, and must procure the prescribed field book and draughting material. The class will be under canvas for two weeks, receiving full instructions in practical work in Stadia, Hydrographical, Land, Railway and other branches of Surveying II. The class is under camp organization. The tents, army sheets, camp utensils, etc., are furnished by the School. Each student must provide himself with a pair of heavy blankets or other bedding, draughting instruments, note book, detail, profile, cross section, and tracing paper. The expense of provisions, cooks, and personal transport must be borne by the students, an advance of \$20.00 being made to cover same.

Throughout the work, the class will be in the field daily, and in the evenings must complete notes and draught the day's work. All notes and draughting must be completed before leaving camp, for qualification. Students must notify the Secretary of their intention to attend this class not later than March 15th, 1914, so that all arrangements may be completed before the camp opens. Students should also provide themselves with any Engineers' Field Book, Tables of Logarithms, etc., they may be able to procure.

ENGINEERING FIELD WORK II.

This work is for Civil Engineering students only and will consist of practical work in Railway Location, Switch Problems, and work connected with Bridge and other Surveys. When weather does not permit of outdoor work, the class will be employed draughting the results of the practical work or working of problems.

Standing is based on term work.

Students must provide themselves with Searles' Field Engineering, \$3.00.
Field Work and Draughting—Sat. 8-12. First term, Professor Macphail.

ENGINEERING FIELD WORK III.

For Civil Engineering students only, consists of practical work in Railway, Structural and Hydraulic Engineering.

When weather does not permit of outdoor work, time allotted will be devoted to the draughting of practical work done, or solution of problems.

Standing is based on term work.

Field Work and Draughting—Fri. 8-12. Professor A. K. Kirkpatrick.

ELECTRICAL ENGINEERING.

PROFESSOR—L. W. Gill, M.Sc.

ASSISTANT PROFESSOR—E. W. Henderson, B.Sc.

LECTURER—C. W. Burroughs, B.Sc.

ELECTRICAL ENGINEERING I.

FUNDAMENTAL PRINCIPLES.

Electromagnetism and electromagnetic induction. The magnetic circuit. Induction of electric currents. Self and mutual induction. Elementary theory of alternating and direct current generators and motors. Common systems of transmission and distribution of electric current. General principles of illumination. Storage batteries.

Lectures—Mon. 9-10; first term, Mon. 9-10, Fri. 9-10; second term, Professor Henderson.

Laboratory—See General Engineering III.

ELECTRICAL ENGINEERING II.

ELEMENTARY ELECTRICAL ENGINEERING.

Electromagnetism and electromagnetic induction. The magnetic circuit. Hysteresis and hysteresis loss. Measurement of magnetic quantities. Effect of temperature and age on the magnetic properties of metals.

The theory construction, and operation of transformers. Elementary theory of direct and alternating current generators and motors.

Lectures—Mon. 11-12, Wed. 9-10, Thurs. 9-10 and 11-12. Professor Henderson.

Laboratory—Sat. 9-12.

ELECTRICAL ENGINEERING III.

ELECTRICAL MEASUREMENTS.

Continuous, alternating, oscillating, and rectified currents. Generated and induced electromotive force. Analysis of complex alternating currents and electromotive forces. Laws governing the flow of current in circuits having resistance, inductance and capacity. Meters and the measurement of electrical quantities.

Lectures—Mon. 9-10; first term. Mon. 9-10, Fri. 9-10; second term.
Professor Gill.

Laboratory—Tues. 1-3.

ELECTRICAL ENGINEERING IV.

Advanced work in drawing, with special attention to electrical apparatus. *Draughting Room—Tues. 3-5, Fri. 1-4.* Mr. Burroughs.

ELECTRICAL ENGINEERING V.

ALTERNATING CURRENT SYSTEMS.

Theory of alternating current generators. Synchronous and Induction Motors. Rotary Converters. Potential Regulators. Phase changing. Multi-phase Systems. Transmission of power. Applications of alternating current in commercial work.

Lectures—Mon. 10-11, Tues. 9-10, Wed 9-10. Professor Gill.

Laboratory—Tues. 2-5.

ELECTRICAL ENGINEERING VI.

DIRECT CURRENT SYSTEMS.

Advanced theory of direct current machines. Series, shunt, and compound generators and motors. Energy losses, and commutation. Efficiency, operation and control of direct current generators and motors. Theory and practical application of storage batteries. Application of direct current in commercial work.

Lectures—Wed. 11-12, Fri. 10-11; first term. Wed. 11-12; second term.
Professor Henderson.

Laboratory—Wed. 2-5; second term.

ELECTRICAL ENGINEERING VII.

GENERAL ELECTRICAL ENGINEERING.

A special laboratory course for students in Mechanical Engineering. *Laboratory—Mon. 10-12.* Mr. Burroughs.

ELECTRICAL ENGINEERING VIII.

ILLUMINATION.

Units and Standards of Illumination. Sources of Light. Distribution of Light. Photometers and Measurement of Illumination. Transmission and Distribution of Electric Power for Lighting Purposes.

Lecture—Fri, 10-11, second term. Professor Gill.

Laboratory—Mon, 2-4; second term.

ELECTRICAL ENGINEERING IX.

ELECTRIC RAILWAYS.

Advantages and Disadvantages of Electric Traction. Electric Motors available for Traction Work. Motor Cars and Electric Locomotives. Methods of Control. Comparison of Characteristics of Steam and Electric Locomotives. Power required for various classes of service. Brakes and Braking, Transmission and Distribution of Power for Traction Purposes.

Lectures—Fri, 9-10, first term; Wed 10-11, second term. Professor Gill.
Professor Gill.

Laboratory—Fri, 1-4; second term.

ELECTRICAL ENGINEERING X.

DESIGNING.

Design and Calculation of performance of transformers, generators, and motors.

Lectures—Wed, 10-11; first term. Mon, 1-2; second term. Professor Gill.

Draughting Room—Fri, 1-4.

ELECTRICAL ENGINEERING XI.

TELEGRAPHY AND TELEPHONY.

The Morse System. Repeaters. Duplex and Multiplex Systems. Combination Systems. Automatic and Printing Telegraph. Railway Block Signal Systems. Modern Telephone Systems. Wireless Telegraphy and Telephony. Simultaneous Telegraphy and Telephony.

Lectures—Wed, 10-11; first term. Mon, 1-2; second term. Prof. Gill.

Laboratory—Fri, 1-4.

LABORATORIES OF ELECTRICAL ENGINEERING.

Laboratory No. 1 is equipped with standard types of direct current motors and generators, the motors being provided with a

special form of automatic brake for purposes of loading. This laboratory is also equipped with a set of large rheostats which are used for absorbing the output of the various generators when loaded for experimental purposes. A wide range of ammeters, voltmeters, and wattmeters completes the equipment.

Laboratory No. 2 is equipped with one 10 H.P. polyphase induction motor, and one 5 H.P. single phase induction motor, each fitted with a brake for loading purposes; one 15 K.W. three phase generator, direct connected to a 25 H.P. motor; five power transformers; one 25 K.W. rotary converter; one 10 K.W. rotary converter, and a full complement of rheostats, ammeters, voltmeters, wattmeters, tachometers, etc.

Laboratory No. 3 is equipped with standard electro-dynamometers and voltmeters for calibrating commercial meters; apparatus for measuring the magnetic properties of the magnetic metals. A Duddell oscillograph for observing potential and current wave forms. A motor-generator set supplies current at low voltage for calibrating ammeters, and a second small motor-generator set supplies potential differences up to 500 volts. Two small sets of storage cells supply steady current for low voltage work.

Laboratory No. 4 is provided with a complement of arc and incandescent lamps; a photometer for measuring illumination. A constant current transformer supplies current for a.c. series arc lamps.

This laboratory is also supplied with a complete outfit of wireless apparatus; also telegraph and telephone receivers and transmitters.

RAILWAY ENGINEERING.

PROFESSOR—A. K. Kirkpatrick.

RAILWAY ENGINEERING I.

CONSTRUCTION.

Lectures comprise: The effects of grades and curves on traffic. Calculations of quantities, overhaul, etc. Duties of resident engineer and his staff on construction. Calculation of progress and final estimates. Records and methods of keeping same. Railway Act of Canada in relation to construction.

Lectures—Thurs. 9-10, Fri. 10-11.

Laboratory—Wed. 3-4.

Reference book—Willard Beaham, *Railway Location*.

RAILWAY ENGINEERING II.

CONSTRUCTION.

Lectures comprise: Design of box and arch culverts. Estimation of waterway required. The protection of embankments. Different methods of obtaining and preparing foundations for structures. Pile and frame trestles. Methods of procedure in rock and earth excavations. Tunneling. Ballasting and tracklaying.

Lecture—Mon. 10-11.

Laboratory—Thurs. 1-2.

RAILWAY ENGINEERING III.

MAINTENANCE.

The upkeep of track, bridges, and buildings; their inspection and methods of repairs and renewals. The duties and responsibilities of the persons in charge.

Lecture—Wed. 11-12.

Laboratory—Thurs. 1-2.

Book of Reference—*Railway Track and Track Work by Tratman.*

STRUCTURES.

General design of railway building, *i.e.*, stations, freight sheds, round-houses, turn-tables; coal handling appliances, sand and water stations, elevators, heating and ventilating of buildings.

Lecture—Mon. 9-10.

MUNICIPAL ENGINEERING.

ASSISTANT PROFESSOR—L. Malcolm, M.A., B.Sc., O.L.S., D.L.S.

MUNICIPAL ENGINEERING I.

WATER SUPPLY.

Lectures comprise: Municipal water supply. Rainfall. Source of supply. Quantity, quality and purification of water. Distribution, designing, and details of construction. Domestic systems.

Lecture—Thurs. 10-11; first term.

MUNICIPAL ENGINEERING II.

THE COLLECTION AND DISPOSAL OF SEWAGE AND REFUSE.

Lectures comprise: The various systems of collection and removal of sewage. Design. Consideration of rainfall, run off, and water consumption. Proportioning of size. Grades and flow in sewers. Methods of construction and materials used. Plumbing. Maintenance of sewer systems, including ventilation, flushing, and inspection. Assessments.

SEWAGE DISPOSAL. Methods employed. Design, construction, and maintenance of the various systems, including bacterial treatment. Refuse disposal. Kinds of refuse. Methods of collection and disposal and economic value of same. Incinerators.

Lecture—Tues. 10-11.

MUNICIPAL ENGINEERING III.

ROADS AND STREETS.

Lectures comprise: Country and city roads and pavements. Lay out, grades, and roadbeds. Various kinds of pavements and methods of construction. Cost and durability. Gutters, curbs, and gullies. Various kinds of walks, methods of construction, materials used. Method of dust prevention. Construction with street railway track. Methods of assessment.

Lecture—Wed. 10-11.

MUNICIPAL ENGINEERING IV.

CITY AND HIGHWAY BRIDGES AND ELECTRIC RAILWAYS.

Aesthetic design of bridges of different types: details of construction. Determination of loads and analysis of stresses taken under General Engineering II. Electric Railways—Subgrade, rails, ties, curves, switches, pavements, power, grades, and bridges.

Lecture—Thurs. 10-11; second term.

Municipal Engineering includes practical work, three hours per week, Saturday, 9 to 12. Projects in water works, sewer designs and paving are set and completed during these hours. As far as possible each students will be given separate problems. A time limit is set on each problem.

HYDRAULIC ENGINEERING.

PROFESSORS—Alexander Macphail, B.Sc.; A. K. Kirkpatrick.

Comprises the study of Hydraulics, Canals, Harbors, River Improvements, Water Power, Irrigation, etc.

HYDRAULIC ENGINEERING I.

HYDRAULICS.

Application of hydrostatic pressure in the case of dams, gates and pipes. Flow of water and measurement of its volume by various orifices and weirs. Flow in open channels, streams, ditches, flumes, etc., and the use and application of these conductors of waters. Flow through tubes and pipes. Use of pipes as conductors of supply for domestic and power purposes. Dynamic and static pressure as applied to motors for power purposes. The efficiency of various water wheels, turbines, etc.

Lectures—Tues. and Thurs. 10-11. Professor Macphail.

Text-book—Merriman, *Hydraulics*.

HYDRAULIC ENGINEERING II.

CANALS, HARBORS AND RIVER IMPROVEMENTS.

Canals.—Economy in design of dimensions, based on traffic. Determination of cross section of canal. Materials required for banks, and method of construction. Dredging, blasting and improvements of existing water-ways. Design of locks, gates, controlling mechanism, etc. Hydraulic lifts.

Harbors.—Advantageous characteristics. Construction of piers, light-houses, breakwaters, etc. Dredging, blasting, etc., for channels. Buoys, channel marks and range lights.

River Improvements.—Dredging of existing water-ways for navigation. Protection of channels, etc.

Lecture—Mon. 2-3. Professor A. K. Kirkpatrick.

Book of Reference:—Watt, *Improvement of Rivers*.

HYDRAULIC ENGINEERING III.

WATER POWER.

Natural watercourses. Dams for water power. Construction of earthen, loose rock and masonry dams and appendages. Storage reservoirs. Spillways and outlet sluices. Development of natural water powers. Transmission of power. Measurement of water power. Turbines and water wheels.

Design of hydraulic power plants.

Lecture—Tues. 11-12. Professor A. K. Kirkpatrick.

Book of Reference:—Jos. P. Frizell, *Water Power*.

HYDRAULIC ENGINEERING IV.

IRRIGATION.

Hydrography. Precipitation, run-off, and stream flow. Evaporation, absorption and seepage. Alkali drainage and sedimentation. Subsurface water sources and sewage for irrigation. Irrigation canals. Classes of irrigation works, alignment, slope and cross-section headworks, and diversion weirs, regulators and escapes. Distributaries. Application of water and pipe irrigation. Estimates.

Lecture—Tues. 9-10. Professor A. K. Kirkpatrick.

Book of Reference:—H. M. Wilson, *Irrigation Engineering*.

STRUCTURAL ENGINEERING.

PROFESSORS—A. K. Kirkpatrick; Alexander Macphail, B.Sc.

Students about to take Structural work should have completed Mathematics I and II, and General Engineering I.

STRUCTURAL ENGINEERING I.

BUILDING CONSTRUCTION.

Selection of building materials, stone, wood, brick, etc. Foundations of buildings, walls, etc. Design of floors, floor beams, walls, roofing materials and other parts of buildings. Joints in wood, stone and iron.

Stone cutting and masonry. Concrete and reinforced concrete.

Students will be required to make independent designs of the various structures dealt with in the lectures.

Lecture—Mon. 10-11. Professor Macphail.

Draughting Room—Fri. 1-4.

STRUCTURAL ENGINEERING II.

BRIDGE ENGINEERING.

Lectures comprise: Examination of bridge site; economic number of spans and piers. Selection of truss or trusses.

Wooden and steel trestles, etc. Design and foundations, abutments and piers. Cofferdams and caissons. Approaches. Ice breakers, etc. Flooring. Hand railings. Guard rails. Stringers, floor beams, ties, etc. Shop work and assembling. Specifications, details, estimates and bills.

Three hours per week will be devoted to design of structures—*Fri. 1-4.*
Lecture—Mon. 3-4. Professor A. K. Kirkpatrick.

STRUCTURAL ENGINEERING III.

DESIGN OF STRUCTURES.

Lectures comprise the design of details in bridge trusses and other structures, and the practical application of General Engineering I and II.

Projects will be given to the class in Roof and Bridge Design according to Standard Specifications usually consisting of a plate girder, riveted truss, pin-connected truss, etc., which must be executed during the four hours allotted to this branch, complete stress sheets, working drawings, estimates, etc., being required.

Standing will be based on term work.

Lecture—Wed. 8-9. Professor Macphail.

Draughting Room—Tues. 2-5.

Text-books:

Merriman, *Roofs and Bridges. Pts. I-IV.*

Cambria Steel Hand-book.

MECHANICAL ENGINEERING.

PROFESSOR—F. O. Willhafft, M.E., A.M.

LECTURER—O. G. Wellton, M.E.

DEMONSTRATOR—C. W. Burroughs, B.Sc.

MECHANICAL ENGINEERING I.

ELEMENTS OF MACHINE DESIGN.

Rivets. Riveting as applied to boilers, tanks, smokeflues, etc. Deduction of theoretical formulæ for single and double riveted lap-joints, single and multiple riveted butt-joints. Boilerstays. Stresses in boiler shells. Practical rules for riveting. Calking. Stresses in thin spherical shells.

Screws. Whitworth's, Sellers', and metric screw-thread systems. Geometrical evolution of threads. Deduction and application of formulae for V and square-threaded screws. Efficiency of screws of various types. Proportioning of screws under various conditions. Allowable working stresses. Analysis of stresses in screws.

Cotters. General theory. Proportioning of cotters under various conditions. Practical rules.

Transmission of power by means of flexible bodies. Belting. General theories. Effect of centrifugal force on belts. Effect of friction. Linear speed limits of belts. Length of belt. Proportioning of pulley, belt and shaft under various conditions. Deficiency of present theories. Rope-transmission. Tensions in suspended flexible cords assuming the form of a catenary. Deduction of formulae, absolute and approximate. Graphic solutions. Tension in suspended cables under different weather conditions.

Lectures—Wed. 11-12, 1-2; Fri. 10-12; first term.

Draughting Room—Mon. 3-5, Tues. 2-5, Sat. 9-12; first term. Mr. Wellton.

Text-book:—Unwin, *Elements of Machine Design*.

MECHANICAL ENGINEERING II.

ELEMENTS OF MACHINE DESIGN—(*Continued*).

Gearing. Transmission of power by means of toothed and frictional gears. Strength of gear-teeth. Speed. Friction. Different kinds of teeth. Efficiency. Hyperboloidal, spiral, spur and conical gearing.

Clutches and couplings for power transmission. Disc clutches. Conical clutches. Friction clutches in general. Toothed clutches. Permanent couplings. Flexible couplings. Couplings permitting of motion in any two non-parallel planes.

Brakes. Theory of the band brake. Power absorbed. Automobile brakes. Dynamometers.

Bearings. Cylindrical and conical bearings. Pivots. Anti-friction curve bearings. Heating of bearings. Lubrication. Roller and ball-bearings. Strength of balls and rollers.

Springs. Spiral and flat springs. Deflection of springs for different loads. Annealing. Vibrations of springs. Potential energy of strained springs.

Elementary dynamics of the reciprocating engine. Tangential crank-effort diagram. Speed and energy of fly-wheels. Stresses in fly-wheel rims. Proportion of bolts for built-up wheels. Adaptations. Experiments on bursting of fly-wheels. Balancing of engines. Vibrations.

Governors. Theories of Watt's, Porter's, and other governors. Energy of the governor. Insensitiveness. Effect of frictional resistance. Astatic and pseudo-astatic governors. Range of speed.

Advanced theories of stresses in general. Stresses in thick cylindrical and spherical shells, flat plates, square and circular. Shrinkage and forced fits. Stresses in guns. Stresses in bent beams.

Several examinations are held in the above subjects during the session.

Lectures—Wed. 11-12, 1-2; Fri. 10-12; second term.

Draughting Room—Mon. 3-5, Tues. 2-5, Sat. 9-12; second term. Mr. Wellton.

Text-book:—Unwin, *Elements of Machine Design*.

MECHANICAL ENGINEERING III.

Work in draughting room as specified under Mechanical Engineering I and II.

MECHANICAL ENGINEERING IV.

THE ELEMENTS OF THE POWER PLANT.

Fuels and combustion. Transfer of heat. Heating Surface. Generation of steam. Types of Boilers. Chimneys. Artificial draft. Smoke prevention. Mechanical stoking. Coal Handling. Use of superheated steam. Feedwater heaters. Condensing systems. Pumping machinery. Compressed air. Gas and oil engines. Gas producers.

Two lectures per week for all engineering students.

Lectures—Mon. and Thurs. 11-12. Professor Willhafft.

MECHANICAL ENGINEERING V.

ADVANCED MACHINE DESIGN.

One complete design of a machine tool, a steam or gas engine, air compressor or pump, is required of each student, including detail drawings and specifications.

Eight hours per week in draughting room, supplemented by lectures for fourth year students in Mechanical Engineering.

Draughting Room—Tues. and Wed. 1-5. Mr. Wellton.

MECHANICAL ENGINEERING VI.

HYDRAULIC MACHINERY AND AIR MACHINERY.

Principles of design and operation of water turbines and pumping machinery, also of fans, compressors, blowing engines, and jet blast and exhaust apparatus. Discussion of water power plants.

Two lectures per week for fourth year Mechanical Engineering students.

Laboratories—Mon. 9-10, Wed. 10-11. Professor Willhafft.

MECHANICAL ENGINEERING VII.

MECHANISM.

A study of link work; wrapping connectors; velocity diagrams of various forms of mechanism; conditions and examples of rolling contact and sliding contact; design of cams; outlines of gear teeth; trains of gears and pulleys.

One lecture per week illustrated by working models, for all engineering students; also one afternoon per week in draughting-room, for Mechanical and Electrical Engineering students.

Lecture—Wed. 9-10. Professor Willhafft.

Draughting Room—Wed. 9-12. Mr. Covington.

MECHANICAL ENGINEERING VIII.

TECHNOLOGY OF FUELS.

Discussion of fuels, gaseous, liquid and solid, with respect to their suitability for power generation. Gas and fuel analysis for engineers. Calculation and calorimetric determination of the heating value of fuels. Gas analysis in connection with the operation of steam boilers. Gas engines and gas producers. Physical tests of lubricants. Causes and prevention of boiler scale. Treatment of feedwaters.

A series of lectures in combination with laboratory work for Electrical and Mechanical Engineering students, three hours per week in fourth year.

Laboratory—Sat. 8-12; second term.

MECHANICAL ENGINEERING IX.

POWER PLANT DESIGN.

Lay-out and specifications of complete plants for steam, gas, or water power. Elements of ventilation and heating.

One lecture per week and six hours in draughting-room for Mechanical Engineering students, fourth year.

Draughting Room—Mon. 1-4; Wed. 9-10, and Thurs. 10-12, 1-3. Mr. Wellton.

WORKS MANAGEMENT.

A course of lectures on Works Management, Cost Accounting, etc., will be given in the session of 1913-14, if the necessary arrangements can be made.

SEMINAR.

One hour per week for third and fourth year Mechanical Engineering students, for the discussion of current engineering literature, and the reading of short papers by students.

Hour to be arranged. Professor Willhafft.

DRAWING.

LECTURER—C. B. Covington, B.E.

DRAWING I.

The lectures and practical work are arranged with the view of preparing the student for the subjects of Mechanical Drawing, Descriptive Geometry, etc., in the different branches of Engineering.

Each student at the opening of the term must provide himself with a set of drawing instruments of approved standard, advising with the instructor in selecting them.

Attendance of five hours a week is required.

The class standing will be determined by the term's work and tests given at various times during the term.

The work will consist of (a) Free-hand lettering adapted to working drawing, (b) Projection Drawing, including intersections and developments; Axonometric Drawings; Simple working drawings.

Sections D, E, and F, Mon. 1-4, Fri. 2-4; sections A, B, and C, Mon. 3-4, Tues. 2-4, Thurs. 1-3.

Texts:—Reinhardt, *Lettering*.

Anthony, *Mechanical Drawing*.

DRAWING II.

WORKING DRAWINGS—The work will include detailing from assembled drawings, making assembled drawings, from detail drawings and from free-hand sketches of details of machines, tracing and blue-printing.

Course A, section 1, Mon. 9-10, 1-3; Course A, section 2, Tues. 2-5;

Courses D and E, section 2, Wed. 2-5; Course E, section 1, Sat. 9-12.

Text-book—Anthony, *Machine Drawing*.

DRAWING III.

Extension of work taken up in Drawing II.

Courses F and G, Fri. 9-12, Sat. 9-12.

SURVEYING.

PROFESSOR—Alexander Macphail, B.Sc.

ASSISTANT PROFESSOR—L. Malcolm, M.A., B.Sc., O. & D.L.S.

All branches of Surveying receive full consideration. During the outdoor instruction students are given every opportunity to become familiar with the instruments. Notes of all field work are

plotted in the draughting-room, and the rules and regulations for field work and instrument-room must be strictly adhered to. Students must be engaged in the work of a class in the hours set apart for it, otherwise their attendance will not be counted.

SURVEYING I.

Lectures comprise: Description, use and adjustment of chains and tapes. Use and adjustment of level, compass, and transit. Elements of levelling and land surveying.

Exercises are required in this work, as the practical part of each class is taken into account for the term's work.

Lectures—Section A, B and C, Mon. 8-9; D, E and F, Fri. 8-9. Professor Malcolm.

Text-book:—Pence & Ketchum, *Surveying Manual*.

SURVEYING II.

FOR SECOND YEAR STUDENTS IN CIVIL ENGINEERING.

Lectures comprise: Adjustment and use of instruments. Mapping—Symbols, and general arrangement, plotting. Railroad Surveying—Curves, curve problems in location, levelling, profiles, elements of switchwork. Topographical Surveying—with stadia, plane table, hand-level, and transit and level. Uses and adjustment of these various instruments. Reconnaissance and simple triangulation. Hydrographic Surveying—Methods; sextant; river surveying; stream flow. Land Surveying—Transit, compass and chain. Resurveys, irregular boundaries, special problems, determination of azimuth, and latitude. Laying out of building, and engineering construction. Earthwork. Discussion of errors.

Lectures—Mon. 9-10, Thurs. 8-9.

Field work—Fri. 1-4. Professor Malcolm.

Text-books:—*Special Notes.*

Pence & Ketchum, *Surveying Manual*.

SURVEYING III.

This course is for second year students in Civil Engineering. It consists of three hours per week practical work in Land, Municipal, and Railway Surveying. This class, when not engaged in outdoor work, meets in the class or draughting room for consideration of problems, given from time to time. The date will be set when problems must be completed, and no problem will be accepted after the expiration of the time set for its completion. The attendance and class-work as well as the completed plans and problems will be considered in the class standing.

Field Work and Draughting—Mon. 1-4. Professor Malcolm.

SURVEYING IV.

FOR CIVIL ENGINEERING STUDENTS ONLY.

Dominion Land Surveying.—Comprising the methods adopted in Survey for Dominion Lands, as laid down in Manual of Survey, issued 1903, by the Dominion Government. Provincial Land Surveying.

Geodesy.—Comprising the principles and methods of procedure in extended triangulation. Determination of Latitude, Azimuth, and Time. Angular Levelling.

Mine Surveying.—Principles involved in Mine Surveys, and problems connected with underground work.

Photographic Surveying.—Principles involved. Field work. Mapping.

Lecture—Fri. 11-12. Professor Macphail.

Field Work and Draughting—Wed. 1-3.

Books of Reference:

Manual of Survey for D.L.S.

Johnson, *Surveying*.

SURVEYING V.

This course is for Civil Engineering students of the Third Year.

Advanced practical work in Land, Municipal, Railway and Construction Engineering will be given. Problems will be set on Transition Curves, Vertical Curves, Earthwork, Location and lay-out of buildings, culverts, Switchwork. Separate problems will be given as far as possible. The same regulations govern this as govern Surveying III.

Field Work and Draughting—Tues. 1-4. Professor Malcolm.

SURVEYING VI.

This course is for Second Year students in Courses A and C.

Lectures comprise: Use and adjustment of instruments. Mapping—symbols, plotting, angles. Elements of Railway Engineering—curves, levelling, profiles. Elements of switchwork. Topographic Surveying—stadia, plane table, hand-level, and level. Adjustment of the above; mapping. Hydrographic Surveying—methods, sextant, river surveying. Earthwork, cross sections, stadia methods.

Lecture—Thurs. 9-10.

Field Work—Wed. 2-5. Professor Malcolm.

Text-book:—*Special Notes*.

Pence & Ketchum, *Surveying Manual*.

SURVEYING VII.

FOR MINING ENGINEERING STUDENTS ONLY.

Dominion Land Surveying—Comprising the methods adopted in Survey of Dominion Lands, as laid down in Manual of Survey, issued 1903, by the Dominion Government. Determination of Latitude, Azimuth and Time.

Ontario Land Surveying.

Mining Surveying—Principles involved in Mine Surveys, and problems connected with underground work.

Topographic Surveying—Extension of work taken in Surveying VI.

Lecture—Fri. 11-12. Professor Malcolm.

Field Work—Thurs. 1-3.

Books of Reference:

Manual of Survey, D.L.S.

Johnson, *Surveying*.

ECONOMICS.

PROFESSOR—O. D. Skelton, M.A., Ph.D.

ASSISTANT PROFESSOR—W. W. Swanson, M.A., Ph.D.

The course consists of lectures on Economics for fourth year students and will have special reference to Canadian conditions and to the interests of students of Practical Science. It will comprise a general outline of economic principles, stressing transportation, money and banking, the nature and organization of joint stock companies and the various forms of corporate securities, the trust problem, taxation, trade unionism, municipal ownership and socialism.

Lecture—Mon. 4-5. Professor Skelton and Professor Swanson.

Text-book—Meade, *Economics of Business*, (De Bower-Elliott Co.).

SHOP WORK.

INSTRUCTORS—S. J. Wood, Machine Shop.

F. Bryant, Blacksmith Shop.

....., Pattern Shop.

Students in all courses except F and G will be given a course of practical work in the workshops of the School as per schedule of courses.

Students in courses F and G shall enter any commercial works approved by the School and take a special course of shop training extending over a period of thirty-six weeks (18 weeks between second and third, and 18 weeks between third and fourth college years; or, in case accommodation can not be secured, they shall attend a special course in the workshops of the School, extending over a period of 8 weeks (4 weeks preceding their third college year and 4 weeks preceding their fourth college year).

To ensure that as many students as possible shall have an opportunity to obtain their shop training in commercial works, arrangements have been made with the management of several of the large manufacturing establishments, so that the students who have completed their second year, may enter upon a suitable course of shop training and receive such remuneration as will more than cover their expenses. In this case the student must present a certificate from the manager of the works in which he has carried out his practical work, stating the character of the work done and the amount of time spent in the various departments.

A complete forge shop has been added to the equipment, so that now efficient instruction can be given in woodworking and pattern-making, in machine shop practice, and in blacksmithing. The forge shop is located in the basement of the workshop building, and is equipped with the latest types of down-draft forges, and electric drive for the blower and exhauster.

PHYSICAL TRAINING.

The Gymnasium is a modern stone building 60 ft. x 105 ft., including in its equipment a plunge bath, shower baths, steel lockers, drying rooms, running track, and undoubtedly the best gymnasium floor in Canada.

Physical training is taken as a class by all first year students for two hours each week. In addition, voluntary classes are given to all other students.

The course includes personal hygiene and the correction of remediable defects. Education of physical powers to the highest point of efficiency, and the cultivation of those social qualities which can be so well taught through the agency of athletic activity. Medi-

cal examination. Measurements. Testing of lungs and heart. Examination of sight and hearing. Correction of round shoulders, flat chest, etc.

PHYSICAL DRILL. A progressive series of exercises with dumb bells, Indian clubs, bar bells, and chest weights, combined with marching tactics and free setting-up exercises. Apparatus work on long horse, parallel bars, tumbling, ladder and horizontal bar. Special attention given to each individual case.

Basketball, indoor baseball, boxing, wrestling, fencing, swimming, running, etc.

A wide option is allowed and credit is given for attendance at gymnasium classes or for membership on the Rugby Football, Soccer, Track team, boxing, wrestling and fencing.

Hours, First Year:

Sections A, B.—Tuesday and Thursday 9-10.

Section C.—Monday 2-3, Wednesday 3-4.

Section D.—Wednesday 3-4, Thursday 2-3.

Sections E, F.—Monday 10-11, Wednesday 2-3.

Voluntary Classes.—Time-table will be posted at the beginning of the session.

LIBRARIES.

Each department of the School of Mining has a departmental library in which the books and periodicals specially related to the subject of the department are kept, and where they can be consulted. There is thus a separate library for physics, chemistry, mining and metallurgy, geology and mineralogy, general and civil engineering, and mechanical and electrical engineering. This arrangement facilitates the consultation of books in the building in which they are most useful. In some cases where a book is much used in more than one department, duplicate copies are provided.

The books are catalogued in card catalogues and numbered in such a way as to be readily accessible. Students have the greatest

freedom in the use of books and journals, which they may take home under conditions varying slightly in the different libraries, but in all cases very liberal.

Books to which students constantly refer in any one branch of their work are for the most part kept in the laboratory or room in which the work is carried on. For example, books in quantitative chemical analysis which are most frequently consulted are placed on a shelf in the quantitative laboratory.

The library of the geology department receives geological survey reports from Britain and nearly all of the British colonies, from the federal government, and the greater number of the United States, and from several other foreign countries.

Students in the School of Mining have access, not only to the departmental libraries of the School, but also to the library of Queen's University which contains upwards of 50,000 volumes. Besides the card catalogue of books there is an extensive card catalogue of important articles in the leading periodicals in the possession of the library.

A list of periodicals taken by the School of Mining is given below.

CHEMISTRY LIBRARY.

Analyst.

Berichte der deutschen chemischen Gesellschaft.

Bulletin of Labor.

Canadian Labor Gazette.

Chemical News.

Experiment Station Record.

Forestry Quarterly.

Inland Revenue Bulletin.

Journal of the American Chemical Society.

Journal of the Canadian Peat Society.

Journal of the Chemical Society.

Journal of Industrial and Chemical Engineering.

Journal of Physical Chemistry.

Journal of the Society of Chemical Industry.

Jahrbuch der Elektrochemie.

Jahresbericht über chemischen Technologie.

Kolloid-chemische Beihefte.

Metallurgical and Chemical Engineering.

Nature.

Proceedings of the Chemical Society.

Pure Products.
Pulp and Paper Magazine.
Science.
Scientific American and Supplement.
Science Progress.
School of Mines Quarterly.
Transactions of the Faraday Society.
Zeitschrift für analytische Chemie.
Zeitschrift für angewandte Chemie.
Zeitschrift für Elektrochemie.
Zeitschrift für Kolloide.
Zeitschrift, für physikalische Chemie.

ENGINEERING LIBRARY.

American Machinist.
American Engineer and Railroad Journal.
Applied Science (Toronto University).
Canadian Patent Office Record.
Canadian Mining Journal.
Cassier's Magazine.
Compressed Air Magazine.
Concrete and Constructional Engineering.
Contract-Record.
Engineering (London).
Electrical World.
Electrical Review.
Electrician.
Electric Journal.
Engineering Magazine.
Engineering Magazine Index.
Engineering-Contracting.
Engineering News.
Engineering Record.
General Electric Review.
Genie Civil.
Horseless Age.
Industrial Engineering.
International Marine Engineering.
Journal of the Western Society of Engineers.
Journal of the Association of Engineering Societies.
Minutes of the Proceedings of the Institution of Civil Engineers.
Municipal Engineering.
Official Journal of Patents.
Power.
Proceedings of the American Gas Institute.

Proceedings of the American Society of Civil Engineers.
Proceedings of the Engineers' Society of Western Pennsylvania
Science Abstracts, Pt. B.
Transactions of the American Institute of Electrical Engineers.
Transactions of the American Society of Mechanical Engineers.
Transactions of the Canadian Society of Civil Engineers.
Zeitschrift des Vereines deutscher Ingenieure.

MINING AND METALLURGY LIBRARY.

British Columbia Mining Record.
Canadian Mining **Journal**.
Chamber of Mines, West Australia Monthly.
Engineering and Mining Journal.
Internationale Zeitschrift für Metallographie.
Iron Age.
Journal of the Chemical and Metallurgical Society of S. Africa.
Metallurgical and Chemical Engineering.
Mining Magazine.
Mining World.
Mining and Scientific Press.
Mines and Minerals.
Mining Science.
Revue de Metallurgie.
Metallurgie.
Stahl und Eisen.
Transactions of the American Electro-Chemical Society.
Transactions of the Institution of Mining Engineers.

PHYSICS LIBRARY.

Astrophysical Journal.
Annalen der Physik.
Journal de Physique.
Physical Review.
Philosophical Magazine.
Proceedings of the Cambridge Philosophical Society.
Science Abstracts Pt. A.

GEOLOGY LIBRARY.

American Journal of Science.
Economic Geology.
Geologisches Centralblatt.
Journal of Geology.
Journal of the Geological Society.
Proceedings of the Geological Society of America.
Tashermak's mineralogische und petrographische Mittheilungen.
Zeitschrift für praktische Geologie.
Zeitschrift für Krystallographie.

ENGINEERING SOCIETY.

The representative student organization of the Faculty of Applied Science is the Engineering Society.

This society exists for the purpose of dealing with all matters concerning its members. All students registered in the Faculty of Applied Science are members of the society.

All candidates for office shall be nominated at the regular meeting next succeeding University Day, this meeting to be held within one week of said University Day.

The annual election of officers shall be held on the Saturday next succeeding the nomination of officers, provided always that at least three days elapse between the nominations and day of election; otherwise the election shall be deferred for one week from the said Saturday.

Regular meetings are held fortnightly, at which all business pertaining to the society is transacted. The society has been very fortunate, in recent years, in securing successful engineers to address the students during the session. These lectures are always interesting and their importance cannot be too strongly emphasized. The first year students especially should avail themselves of every opportunity afforded them to become acquainted with the leading men in the various professions. Any student members, who wishes to read a scientific paper before the society, will always find the executive of the Engineering Society ready and willing to arrange a date.

It is through this student society that the conduct of the Science students is regulated. The Vigilance Committee, which acts as a "court" has one or more sittings a year, when all offenders against the written and unwritten laws are dealt with. The Vigilance Committee is directly responsible to the Engineering Society and its officers are elected annually.

The Engineering Society and the graduates and alumni of the School of Mining issue an *Annual Directory*. This directory contains a complete list of all the graduates and alumni, with their professional record and addresses, and also a complete list of all students registered in the School of Mining. In connection with the directory is an Information Bureau, whose object is to assist the graduates and students, as far as possible, in securing suitable positions. All inquiries and applications should be made to the Secretary, C. W. Drury, Nicol Hall. The Engineering Society has also installed a Book-store in the Engineering Building and there all science text-books and supplies may be purchased at reasonable prices.

The officers of the Engineering Society and Vigilance Committee for the year 1912-13 are as follows:—Hon. Pres., Prof. William Nicol; Pres., W. Dalziel; 1st Vice-Pres., H. J. Dunlop; 2nd Vice-Pres., A. E. MacCrae; Secretary, J. G. Cameron; Asst. Secretary, D. G. Browne; Treasurer, J. C. Ross. Committee—G. W. MacLeod, '13; R. Hepenstall, '14; R. L. Dunsmore, '15; C. G. Wright, '16.

Vigilance Committee:—Sr. Judge, A. K. Anderson; Jr. Judge, R. W. MacKenzie; Sr. Pros. Attorney, F. M. Melrose; Clerk, W. F. Noonan; Crier, T. L. Hughson; Sheriff, C. W. Greenland; Chief of Police, J. P. Harvey. Constables:—W. Fairlie '13, W. E. Lamb '13; W. G. Pearce '14, A. E. McVittie '14; M. S. Shields '15, C. B. Ferris '15; E. Robb '16, E. C. Keeley '16.

NO. 5 COMPANY, CANADIAN ENGINEERS.

This military organization is composed entirely of the staff and students of the School of Mining.

The Company parades every Thursday afternoon at the City Armouries at 3.30 p.m. Provision is made in the time-table to allow members of the Company time for drill.

The Company, being one of Engineers, the main part of the instruction is along the line of military engineering.

OFFICERS :

MAJOR—A. Macphail.
CAPTAIN—L. Malcolm.
LIEUTENANTS—D. Ellis.
W. Manhard.
W. Dalziel.
S. McCann.
J. Aird.

GRADUATES.

In the list are included graduates in the Faculty of Practical Science (B.Sc. and M.E.) and those graduates in Arts (B.A., M.A. and D.Sc.) since 1887, who after graduation have devoted themselves to scientific pursuits.

Graduates will confer a favor by forwarding changes of address to the Secretary.

†Honour standing, granted since 1909 (see page).

Name.	Date of Graduation.	Address.
Agassiz, W. G. S., B.Sc.....	1909..	173 Union St., Kingston, Ont.
Akins, J. R., B.Sc.....	1907..	Dept. of Interior, Ottawa.
Alder, W. R., B.Sc.....	1907..	Prescott, Ont.
Anson-Cartwright, R. H. M. B.Sc.	1904..	34 Dundonald St., Toronto, Ont.
Anglin, D. G., B.Sc.....	1911..	56 Earl St., Kingston, Ont.
Armstrong, W. B., B.Sc.....	1911..	Topographical Survey, Ottawa.
Arthur, A. J., B.Sc.....	1910..	Carleton Place, Ont.
Asselstine, Burton, B.Sc.....	1911..	Box 23, Belleville, Ont.
Bailie, A. A., B.Sc.....	1906..	Billings' Bridge, Ont.
Baker, C. W., B.Sc.	1905..	50 Garfield Ave., S., Hamilton, Ont.
Baker, H. S., B.Sc.....	1902..	52 North Main St., Niagara Falls, Ont.
Baker, S. C., B.Sc....	1903..	Vermillion, Alberta.
Baker, M. B., B.A., B.Sc.....	1902..	Professor of Geology, School of Mining, Kingston.
Baker, Wm. C., M.A.	1895..	Associate Professor of Physics, School of Mining, Kingston.
Bartlett, J., B.Sc.	1907..	267 University Ave., Kingston.
Bartlett, R., B.Sc.....	1912..	267 University Ave., Kingston.
Bateman, A. M., B.Sc.....	1910..	67 Clarence St., Kingston.
Bateman, G. C., B.Sc.....	1905..	801 Traders Bank Bldg, Toronto, Ont.
Battersby, W. F., B.Sc.....	1910..	56 Charlotte St., Brantford, Ont.
Bell, F. A., B.Sc.....	1910..	Court House, St. Thomas, Ont.
Bell, James M., M.A.	1899..	Consulting Geologist, London, Eng.
Bell, W. A., B.Sc.....	1911..	81 Elm St., St. Thomas, Ont.
Bennett, Joseph, B.Sc.....	1911..	Kingston, Ont.
Berney, K. C., B.Sc.....	1906..	Athens, Ont.
Berry, H. F., B.Sc.....	1912..	Gananoque, Ont.
†Bertram, A. S., B.Sc.....	1912..	Dundas, Ont.
†Bertram, H. G., B.Sc.....	1910..	Dundas, Ont.
Birkett, E. H., B.Sc.....	1910..	Kingston, Ont.
Blenkhorn, S., B.Sc.	1909..	Canning, N.S.
Bogart, J. L. H., B.Sc.....	1903..	Militia Department, Ottawa.
Bolton, G. E., B.Sc.....	1912..	Perth, Ont.

Name.	Date of Graduation.	Address.
Bolton, L. L., M.A., B.Sc.....	1906..	Mines Dept., L. Superior Corporation, Sault Ste. Marie, Ont.
†Borden, Perry A., B.Sc.....	1911..	Hydro-Electric Commission, Continental Life Bldg, Toronto.
†Bothwell, N. D., B.Sc.....	1911..	Bankhead, Alberta.
Bourgoing, S. B.Sc.....	1912..	Tadousac, Que.
Bowen, N. L., M.A., '07; B.Sc., '09; Ph.D.	1912..	Kingston, Ont.
†Bradley, H., B.Sc.....	1911..	532 Dufferin Ave., London, Ont.
Brewster, F. A., B.Sc.	1909..	Banff, Alta.
Brewster, J. A., B.Sc.....	1911..	Edmonton, Alta.
Brock, R. W., M.A.....	1895..	Geological Survey, Ottawa.
Brown, E. W., B.Sc.....	1908..	Hawkesbury, Ont.
Browne, P. J., B.Sc.....	1909..	144 Barrie St., Kingston
Brown, T., B.Sc.	1904..	Hawkesbury, Ont.
†Bruce, E. L., B.A., B.Sc.....	1909..	Smith Falls, Ont.
Burrows, A. P., M.A., B.Sc.....	1902..	Bureau of Mines, Toronto.
Burrows, M., B.Sc.....	1912..	Foxboro, Ont.
†Burroughs, C. W., B.Sc.....	1911..	Smith St., Kingston, Ont.
Butler, S. H., B.Sc.....	1910..	Loreburn, Sask.
Cairnes, D. D., B.Sc., '05; M.E., '06 Ph.D.	1910..	Geological Survey, Ottawa.
Callander, R., B.Sc.	1910..	School of Mining, Kingston.
Calvin, J. D., B.A., B.Sc.....	1907..	Garden Island, Ont.
Cameron, G., B.Sc.....	1912..	Waterdown, Ont.
Campbell, A. S., B.Sc.....	1907..	Civil Engineer, Kingston, Ont.
Campbell, T. D., B.Sc.....	1909..	Perth, Ontario.
Campbell, W. M., B.Sc.....	1909..	(Deceased).
Carmichael, J. E., '09; M.D.....	1911..	Strathcona, Alberta.
Carscallén, H. A., B.Sc.....	1911..	Enterprise, Ont.
Carr-Harris, A. A., B.Sc.....	1906..	Cananea, Sonora, Mexico.
Cartwright, C. T., B.Sc. '05; M.E..	1911..	Dept. of Mines, Ottawa.
Caton, W. C., B.Sc.....	1912..	Odessa, Ont.
Caverhill, A. J., B.Sc.....	1911..	Vanneck P. O., Ont.
Cavers, T. W., B.Sc.	1904..	Copperhill, Tenn., U.S.A.
Chartrand, D. E., B.Sc.....	1909..	Chartrand P. O., Ont.
†Clarke, K. S., B.Sc.....	1910..	Magpie Mine, Ont.
Code, E. S., B.Sc.....	1907..	206 Central Bldg., Seattle, Wash.
Code, L. B., B.Sc.....	1906..	223 Hannis St., Vancouver, B.C.
Collins, E. A., B.Sc.....	1905..	Kingston, Ont.
Connell, F. M., B.Sc.....	1906..	Royal Bank Bldg., Toronto.
Cook, W. E., B.Sc.....	1912..	Kingston, Ont.
Cooper, R. H., B.Sc.....	1909..	North Sydney, N.S.
Cordukes, J. P., B.Sc.....	1908..	Topographical Survey, Ottawa.

Name.	Date of Graduation.	Address.
Corkill, E. T., B.Sc., '04; M.E.....	1905..	Bureau of Mines, Toronto.
Craig, H. B. R., B.Sc.....	1903..	Public Works Dept. of Canada, Windsor.
Craig, J. D., B.A. '97, B.Sc.....	1900..	Dominion Observatory, Ottawa, Ont.
Crawford, V. W., B.A. '09, B.Sc....	1910..	Kingston, Ont.
Cumming, Alfred, B.Sc.	1905..	Topographical Survey, Ottawa.
Cummings, A. B., B.Sc.....	1908..	Box 163, Fernie, B.C.
Currie, P. W., B.Sc.....	1900..	Dept. of Interior, Ont.
Curtin, C. J., B.A. '05, B.Sc.....	1907..	Brockville, Ont.
Daley, J. C., B.Sc.....	1909..	Kingston, Ont.
†Davis, N. B., B.Sc.....	1911..	126 Nelson St., Kingston.
Dawson, S. G., B.Sc.....	1912..	149 Patterson Ave., Ottawa.
Dempster, H. O., B.Sc.....	1908..	Gananoque, Ont.
Dennis, E. M., B.Sc.....	1904..	64 Aylmer Ave., Ottawa.
Dewar, D. F., B.Sc.....	1912..	Pembroke, Ont.
Dillabough, J. V., B.Sc.....	1905..	Office Engineer, Hudson Bay Rail- way, Winnipeg, Man.
Dobbs, G. G., B.Sc. '06, M.E.....	1908..	Box 97, Bessemer, Alabama, U. S. A.
Dobson, J. V., B.Sc.....	1910..	Picton, Ont.
Donnelly, John, M.E.	1898..	Mgr. Donnelly Wrecking Co., Kingston, Ont.
Donoghue, W. B., B.Sc.....	1912..	Burritts Rapids, Ont.
†Drewry, G. F., B.Sc.....	1910..	Stirling, Ont.
Drury, C. W., B.Sc. 1909, A.M.	1910..	School of Mining, Kingston.
Dunkley, J. B., B.Sc.....	1910..	Picton, Ont.
Dwyer, E., B.Sc.	1902..	Westinghouse Co., Hamilton, Ont.
†Dwyer, W. O., M.A. '07, B.Sc.....	1909..	79 Johnson St., Kingston.
Earle, W. S., C.E.....	1910..	525 Vancouver Bldg, Vancouver, B.C.
Elliott, R. A., B.Sc.....	1912..	Woodstock, Ont.
†Ellis, D. S., M.A. '08, B.Sc.....	1910..	School of Mining, Kingston, Ont.
Ewart, McLaren, B.Sc.....	1910..	Care Resident Engineer C. P. R., Moosejaw, Sask.
Fairburn, H. P., B.Sc.....	1912..	Pembroke, Ont.
Fairlie, M. F., B.Sc.....	1902..	Cobalt, Ont.
Fairlie, Y. U., B.Sc.....	1905..	Hydro-Electric Co., Toronto, Ont.
Ferguson, M. U., B.Sc.....	1904..	City Engineer, Stratford, Ont.
Finlay, A. B., B.Sc.	1908..	407 Builders' Exchange Bldg., Win- nipeg, Man.
Finlayson, M. D., B.Sc.....	1903..	Grand River, N.S.
Finnie, H. V., B.Sc.	1906..	Lachine Locks, Que.
Fitzgerald, C. C., B.Sc.....	1912..	Parry Sound, Ont.

Name.	Date of Graduation.	Address.
Fleming, A. A., B.A.....	1904.	Lakefield, Ont.
Fleming, A. G., B.Sc.....	1908.	Canada Cement Co., Hull, P.Q.
Fleming, D. B., B.Sc.....	1908.	268 Thomas St., Peterboro, Ont.
Fleming, H. K., B.Sc.....	1909.	Craigleith, Ont.
Fletcher, W. J., B.Sc.....	1910.	33 Windsor Ave., Windsor, Ont.
Fortescue, C. L., B.Sc.....	1898.	Westinghouse Co., Pittsburg, Pa.
Fox, C. B., M.A.....	1895.	Pittsburg Reduction Co., East St. Louis, Ill.
Fraser, D. J., B.A., '07; D.L.S....	1911.	International Boundary Surveys' Dept. of Interior, Ottawa.
Frost, E. S., B.Sc.....	1910.	Pembroke, Ont.
Gage, R. G., B.Sc.....	1905.	Railway Signal Co. of Canada Ltd., Lachine, P.Q.
Gallagher, O. G., B.Sc.....	1910.	134 Osgoode St., Ottawa.
Gates, A. B., B.Sc.....	1911.	627 Princess St., Kingston.
George, G. A., B.Sc.....	1912.	Eganville, Ont.
George, W. B., B.Sc.....	1911.	Eganville, Ont.
Germain, H. A., B.Sc.....	1907.	Gen. Electric Co., Pittsfield, Mass.
Gillette, O., B.Sc.....	1910.	Dome Mines, South Porcupine, Ont.
Gleeson, J. V., B.Sc.....	1904.	123 King St. West, Kingston.
Gleeson, L. J., B.Sc.....	1907.	Drawer V., Calgary, Alberta.
Goedike, F. B., B.Sc.....	1910.	219 Midland St., Toronto.
Goodwin, E. L., B.Sc.....	1912.	Alice St., Kingston, Ont.
†Goodwin, W. M., B.A. '09, B.Sc....	1911.	Alice St., Kingston, Ont.
Gordainer, W. M., B.Sc.....	1903.	Election, Wash.
Gow, D. B., B.Sc.....	1912.	Vancouver, B.C.
Graham, S. N., B.Sc. '00, C.E.....	1903.	Care Canadian Mining Journal, Toronto, Ont.
Grant, A. M., B.Sc.....	1908.	Topographical Survey, Ottawa.
Grant, J. K., B.Sc.....	1904.	601 Rogers Bldg., Vancouver, B.C.
Gray, A. W., B.Sc.....	1912.	Toronto, Ont.
Grenon, J. E., C.E.....	1906.	Box 186, Chicoutimi, Que.
Griesbach, W. C., B.Sc.....	1912.	Collingwood, Ont.
Grover, G. A., B.Sc.....	1902.	85 Bay St., Toronto, Ont.
Guess, G. A., M.A.....	1895.	Professor of Metallurgy, Toronto University, Toronto, Ont.
Guess, H. A., M.A.....	1895.	Gen. Mgr. Federal Lead Co., Flat River, Missouri.
Haddow, A. W., B.Sc.....	1909.	City Engineering Dept., Edmon- ton, Alberta.
Hambly, W. R., B.Sc.....	1910.	Napanee, Ont.
Harding, W. M., B.Sc.....	1908.	Box 653, Oshawa, Ont.
Harding, W. D., B.Sc.....	1912.	Box 653, Oshawa, Ont.

Name.	Date of Graduation.	Address.
Hays, C. L., B.Sc.	1909..	Campbellford, Ont.
Hazlett, J. W., B.A., B.Sc.....	1903..	(Deceased.)
Henderson, E. W., B.Sc.....	1905..	Asst. Professor of Electrical Engineering, School of Mining, Kingston, Ont.
Herriot, G. H., B.Sc.....	1907..	Souris, Man.
Hill, Jas., M.A. '06, B.Sc.....	1908..	Albert St., Kingston, Ont.
Holland, A. A., B.Sc.....	1910..	309 West 99th St., New York, N.Y
Houston, D. W., B.Sc.....	1907..	Tabor, Iowa.
Howell, G. E., B.Sc.....	1912..	Hamilton, Ont.
Huber, W., B.Sc.....	1908..	Bracebridge, Ont.
Huff, F. H., B.Sc.....	1912..	Meaford, Ont.
Hughston, W. G., B.Sc.....	1911..	6 Simcoe St., Niagara Falls, Ont.
†Hutchison, R. H., B.Sc.....	1911..	Coniagas Mine, Cobalt, Ont.
Instant, R., B.A.	1895..	Norwich Ont. .
Irwin, R. T., B.Sc.....	1908..	Porcupine, Ont.
†Jackson, G. J., B.Sc.....	1909..	Care Cleveland & Cameron, Vancouver, B.C.
Jackson, H. G., B.Sc.....	1903..	Rennie, Man.
Jeffery, J. J., B.Sc.....	1908..	Elder's Mills, Ont.
Jeffery, R. T., B.Sc.....	1908..	Elder's Mills, Ont.
†Jenkins, G. A., B.Sc.....	1909..	Warren Brass Co., 59 Temple Place, Boston, Mass.
Jenkins, W. E., B.Sc.....	1907..	Box 325, Edmonton, Alberta.
Johnston, P. K., B.Sc.....	1910..	22nd St. W. Fairmont Grove, Upland, California.
Johnston, W. A., M.A. '03, B.Sc....	1905..	Geological Survey, Ottawa.
Keeley, D. E., B.Sc.....	1910..	Hosmer, B.C.
Keith, G. C., B.Sc. '07, M.Sc.....	1911..	435 Grace St., Toronto.
Kelso, J. A., B.Sc. '09, M.Sc.....	1911..	Wallacetown, Ont.
Kemp, M.A., B.Sc.....	1912..	Westboro, Ont.
†Kendall, L. E., B.Sc.....	1912..	Ottawa, Ont.
Kilburn, D. G., B.Sc.....	1907..	Boy 154, North Bay, Ont.
Kilburn, G. H., B.Sc.....	1909..	Asst. Eng., Le Roi Mine, Rossland, B.C.
King, J. A. S., B.Sc.....	1909..	Souris, Manitoba.
King, J. L., B.Sc.....	1907..	1606 Nelson St., Vancouver, B.C.
Kinnear, L. A., B.Sc.....	1912..	Port Colborne, Ont.
†Kirkpatrick, A. M., B.Sc.	1911..	68 Johnson St., Kingston.
Kirkpatrick, Guy H., B.Sc. '97, M.E.	1898..	Vancouver Club, Vancouver, B.C.
Knight, C. W., B.Sc.....	1903..	Bureau of Mines, Toronto.
Lamsom, B.F., B.Sc.....	1912..	Regina, Sask.
Lavoie, E., B.Sc.	1907..	Chicoutimi, Que.
Lawler, A. P., B.Sc.	1911..	218 Alfred St., Kingston, Ont.

Name.	Date of Graduation.	Address.
†Lawson, W. E., B.Sc.	1909.	Geological Survey, Ottawa.
Lazier, F. S., B.Sc.	1907.	Trent Canal, Campbellford, Ont.
Lennox, J. S., B.Sc.	1906.	49 Hull Ave., Pittsfield, Mass.
†Lennox, T. C., B.Sc.	1911.	609 Boyd Ave., Woodhaven, L.I., New York.
Lewis, A. L., B.Sc.	1912.	172 E. Main St., Hamilton, Ont.
Lodge, W. L., B.Sc.	1903.	State Agric. College, Lansing, Mich.
Longmore, E. L., B.Sc.	1912.	Camden East, Ont.
Longwell, A., B.A. '00, B.Sc.	1903.	Care Canadian Mining Journal, Toronto.
Losee, W. H., B.Sc.	1912.	Collins Bay, Ont.
Mabee, H. C., B.Sc.	1898.	Berry Bros., Detroit, Mich.
Madden, M. S., B.Sc.	1910.	Napanee, Ont.
Malcolm, L., M.A., B.Sc.	1907.	Asst. Professor Civil Engineering, School of Mining, Kingston.
Malloch, E. S., B.Sc.	1910.	28 Duke St., Hamilton, Ont.
Malloch, G. S., B.A. '02, B.Sc.	1906.	Geological Survey, Ottawa.
Malloch, N., B.Sc.	1912.	Arnprior, Ont.
Malone, E. E., B.Sc.	1904.	Newmarket, Ont.
Marshall, J. H. G., B.Sc.	1908.	Stella, Ont.
Mateer, T. J., B.Sc.	1910.	Deloro, Ont.
Malcolm, Wyatt, M.A.	1906.	Geological Survey, Ottawa.
Matheson, H., B.Sc.	1907.	Armow P. O., Ont.
Meikle, A. U., B.Sc.	1912.	40 Clergy St., Kingston.
Meikle, M., B.Sc.	1912.	40 Clergy St., Kingston.
Merritt, C. P., B.Sc.	1899.	(Deceased.)
Milden, A. J., B.Sc.	1908.	Cornwall, Ont.
Miller, T. R., B.Sc.	1906.	91 Gore St., Kingston, Ont.
Milliken, J. B., B.A., B.Sc.	1908.	Topographical Survey, Ottawa.
†Mills, T. S., B.A. '10, B.Sc.	1911.	120 University Ave., Kingston.
Montgomery, O. M., B.Sc.	1905.	Box 712, New Kensington, Pa.
Moran, P. J., B.Sc.	1911.	Saints' Rest, Kingston, Ont.
†Morgan, A. L., B.Sc.	1912.	Truro, N.S.
Morrison, A. G., B.Sc.	1910.	Woodstock, Ont.
Morrison, W. M., B.Sc.	1910.	Dept. of Mines, Ottawa, Ont.
Moyer, J. C., B.Sc.	1912.	St. Catharines, Ont.
Mullin, T. B., B.Sc.	1912.	Acton, Ont.
Murphy, A. A., B.Sc.	1907.	Portland, Ont.
Murray, C. W., B.Sc.	1907.	Mission City, B.C.
Murray, J. C., B.A., B.Sc.	1901.	Editor Can. Mining Journal, Toronto.
MacClement, W. T., M.A., D.Sc.	1903.	Prof. of Botany, Queen's Univer- sity.

Name.	Date of Graduation,	Address.
Macdonald, G., B.A., B.Sc.....	1878..	(Deceased.)
MacDougall, F. H., B.A. '02; M.A. Ph.D.	1903..	Professor of Chemistry, University of Calgary, Calgary, Alta.
MacGregor, S. E., B.Sc.....	1912..	Parkhill, Ont.
Mackenzie, G. C., B.Sc.....	1903..	Dept. of Mines, Ottawa.
MacIlquham, W. L., B.Sc.....	1905..	Topographical Survey, Ottawa.
MacKay, G. J., B.Sc.	1907..	499 Ninth St., Owen Sound, Ont.
Mackenzie, H. A., B.Sc.....	1907..	Moulinette, Ont.
MacKay, A. A., B.Sc.	1910..	Supt. Helen Mine, Helen Mine, Ont.
Mackie, F. H., B.Sc.	1903..	126 Flora St., Ottawa.
MacNeill, W. K., B.A., B.Sc.....	1903..	5 Queen's Park, Toronto.
Macphail, J. G., B.A. '03, B.Sc.....	1905..	Marine Dept., Ottawa.
MacKay, B. R., B.Sc.....	1908..	Geological Survey, Ottawa.
Mac Rostie, N. B., B.Sc.....	1911..	Metcalfe, Ont.
McArthur, F., B.Sc.....	1907..	City Engineer, Yorkton, Sask.
McCallum, H. E., B.A., B.Sc.....	1903..	(Deceased.)
McCann, W. S., B.Sc.....	1912..	Kingston, Ont.
McColl, C. R., B.Sc.....	1908..	Walkerville, Ont.
McCulloch, R. O., B.Sc.....	1907..	Souris, Man.
McCullough, F. H., B.Sc.....	1912..	Toronto, Ont.
McDiarmid, S. S. R., B.Sc.....	1903..	(Address wanted.)
McDowall, R. J., B.Sc.....	1912..	9 Wellington St., Kingston, Ont.
McEachern, J. J., B.Sc.	1910..	Gravenhurst, Ont.
McEwen, D. F., B.Sc.....	1907..	Hensall, Ont.
McEwen, L., B.Sc.	1912..	Warina, Ont.
McGinnis, T. A., B.Sc.....	1909..	Belleville, Ont.
McGinnis, W. C., B.Sc.....	1908..	Belleville, Ont.
McIntosh, J. S., B.Sc.....	1909..	Morrisburg, Ont.
McKenzie, H. A., B.Sc.....	1907..	Moulmette, Ont.
McKenzie, J. E., B.Sc.....	1912..	Calgary, Alta.
McKenzie, R. M., B.Sc.....	1912..	Eganville, Ont.
McKenzie, M., B.Sc.	1908..	Lake Megantic, Que.
†McKiel, H. W., B.A. '08; B.Sc...	1912..	Guelph, Ont.
McLaren, A. A., B.Sc.	1911..	Care Appalachian Power Co., Byllesby, Va.
McLaren, G. R., B.Sc.....	1907..	Box 247, Perth, Ont.
McLennan, J. D., B.A., B.Sc.....	1902..	(Deceased.)
McLennan, K. R., B.Sc.	1904..	Room 407, G.T. Bldg, Montreal.
McNab, A. J., B.A., B.Sc.....	1902..	Mason Valley Mine, Nevada, U. S. A.
McNeice, L. F. C.E.	1912..	Reay, Ont.
McPherson, J. C. R., B.Sc.....	1912..	Woodstock, Ont.

Date of
Graduation.

Name.

Address.

McRae, A. D., B.A. '00, B.Sc.	1902..47	First Ave., Ottawa.
Neilson, A. C., B.Sc.....	1909..	Stella, Ont.
Neilson, L. R., B.Sc.	1910..	Stella, Ont.
Neish, A. C., B.A. '98, A.M. '00, Ph.D.	1904..	Instructor in Chemistry, Columbia University, New York.
Newlands, N. A., B.Sc.....	1910..	Care G. W. Jackson Engineering Co., Yonkers, N.Y.
†Newman, W. A., B.Sc.....	1911..	213 William St., Kingston.
Nicol, D. S., B.Sc.....	1909..	Care Ry. Signal Co., Lachine, Que. or Cataraqui, Ont.
Nichols, D. A., B.Sc.....	1911..	Victoria Museum, Ottawa.
Nicol, Wm., M.A.	1889..	Professor of Mineralogy, King- ston.
Noble, D. S., B.Sc.....	1902..	(Deceased.)
Norrish, B. E., B.Sc.....	1908..	Topographical Survey, Ottawa.
†Norrish, W. H., B.Sc.....	1912..	Guelph, Ont.
Ockley, R. F., B.Sc.	1910..99	Clergy St. W., Kingston, Ont.
Orford, C., B.Sc.....	1908..	Delamar, Idaho.
Orr, W. J., B.A., B.Sc.	1909..	1207 Traders' Bank Bldg. Toronto
Orser, E. H., B.Sc.....	1910..	Kingston, Ont.
Osborne, J. K., B.Sc.....	1909..	114 Euclid St., Ishpheming, Mich.
Peeling, C. U., B.Sc.....	1909..	Local Mgr. Oshawa Electric Light Co., Oshawa, Ont.
Pense, E. H., B.Sc.	1903..	Public Works Dept., Ottawa.
Peppard, H. M., B.Sc.....	1907..	Box 461, Springhill, N.S.
Perry, O. M., B.Sc.....	1909..	Belleville, Ont.
Phillips, H. L. B.Sc.....	1912..	Cornwall, Ont.
Pierce, G. B. B.Sc.....	1912..	60 Victoria St., Kingston, Ont.
Pinkerton, W. A., B.Sc.....	1906..	Yorkton, Ont.
Pope, F. J., M.A. '91, Ph.D.....	1899..	Room 1503, 71 Broadway, New York City.
Potter, R., B.Sc.	1907..	City Engineer, Fernie, B.C.
Prittie, L. C., B.Sc.....	1912..	Pembroke, Ont.
Purvis, S. A., B.Sc.....	1912..	229 Alfred St., Kingston, Ont.
Ramsay, J. H., B.Sc.....	1911..99	Gilmour St., Ottawa, Ont.
Ransom, F., B.Sc.	1909..	Dept. of Mines, Ottawa.
Rawlins, J. W., B.A. '99, B.Sc.....	1901..	Copper Cliff, Ont.
Redmond, A. V., B.Sc.....	1903..	Care T. C. Railway, Armstrong, Via Superior Jct., Ont.
Reid, F. D., B.Sc.....	1904..	Care Coniagas Mines Ltd., Cobalt, Ont.
Reid, J. A., B.Sc.	1902..	Middleton, N.S.
Reid, T. J., B.Sc.....	1911..	Kingston, Ont.

Name.	Date of Graduation.	Address.
Rice, G. T., B.Sc.....	1912..	Winnipeg, Man.
Richardson, G. T., B.Sc.....	1906..	Kingston, Ont.
Richmond, D. W., B.Sc.....	1908..	Brighton, Ont.
Ritchie, G., B.A., B.Sc.....		Toronto, Ont.
†J. A. T. Robertson, B.Sc.....	1912..	St. Catharines, Ont.
Robertson, J. J., B.Sc.....	1906..	(Address wanted.)
Robinson, S. D., B.Sc.....	1911..	93 Division St., Kingston, Ont.
Rockwell, D. B., B.Sc.	1908..	Pacific Coal Co., South Vancouver, B.C.
†Rogers, R. A., B.Sc.....	1912..	Gananoque, Ont.
Rogers, W. R., B.Sc.....	1907..	Bureau of Mines, Toronto.
Rooney, J. T., B.Sc.	1911..	(Address wanted.)
Rose, B., B.Sc.	1909..	Winchester, Ont.
†Rose, J. H., B.Sc.	1910..	Trail, B.C.
Rose, S. L. E., B.Sc.....	1903..	19 Plymouth Ave., Schnectady, N.Y.
Ryan, F. H., B.Sc.....	1909..	Camden East, Ont.
Saint, J. B., B.Sc.	1909..	323 8th Ave. W., Vancouver, B.C.
Sands, J. M., B.Sc.....	1907..	Box 25, Panuco, Vera Cruz, Mex- ico.
Saunders, H. C., B.Sc.....	1909..	Alice St., Kingston.
Sawyer, E. P., B.Sc.....	1912..	30 St. John St., Montreal, Que.
Schofield, S. J., B.A. '06, M.A. '07, B.Sc. '08; Ph.D.	1912..	Geological Survey, Ottawa.
Scott, A., B.A.	1899..	Glenmorris, Ont.
Scott, H. H., B.Sc.	1905..	Perth, Ont.
Scott, J. M., B.Sc.....	1912..	118 Huron St., Toronto, Ont.
Scott, J. N., B.Sc.....	1909..	Wallaceburg, Ont.
Scott, O. N., B.Sc.....	1902..	Consulting Mining Engineer, Royal Bank Bldg., Toronto.
Scott, T. S., B.A. '94; B.Sc.....	1897..	717 Dominion Trust Bldg., Van- couver, B.C.
†Scovil, S. S., B.Sc.....	1912..	Kenora, Ont.
Sears, J., B.Sc.	1905..	99 Barker St., Niagara Falls South, Ont.
Shirley, E. R., B.Sc.....	1912..	Peterboro, Ont.
Shorey, E. C., B.A. '86, M.A. '87, D.Sc.	1896..	Bureau of Soils, U. S. Dept. of Agric., Washington, D.C.
Shorey, P. M., B.Sc.	1906..	Lindsay, Ont.
Silver, L. P., B.Sc. '02; A.M.....	1905..	420 St. Paul St., Montreal, Que.
Simmons, G. A., B.Sc. '10; M.D....	1912..	Simmons, Que.
Sine, F., M.A. '06, B.Sc.....	1908..	Sydenham, Ont.

Name.	Date of Graduation.	Address.
†Sirvage, E. G., B.Sc.	1912	Chesterville, Ont.
Slipper, S. E., B.Sc.	1910	42 S. Algoma St., Port Arthur, Ont.
Sloan, D., B.Sc.	1905	Steamboat, B.C.
Smeaton, W. F., B.Sc.	1901	Buffalo-Ontario Smelting Co., Kingston, Ont.
†Smyth, E. S., B.Sc.	1912	77 Duke St., Berlin, Ont.
Smyth, W. L., B.Sc.	1906	1731 Trafalgar Road, Vancouver, B.C.
Sommerville, J. E., B.Sc.	1912	Winthrop, Ont.
Spearman, C., B.Sc.	1910	Stittsville, Ont.
Speirs, T. B., B.Sc.	1909	Appleton, Ont.
Squire, A. M., B.Sc.	1909	Room 600 La Salle St. Station, Chicago, Ill.
Squire, R. L., B.Sc.	1904	Kingston, Ont.
†Stanley, J. L., B.Sc.	1910	Port Colborne, Ont.
Stanley, J. N., M.A. '01, B.Sc.	1908	Port Colborne, Ont.
Stanley, O., B.Sc.	1910	Port Colborne, Ont.
Stevens, F. G., B.Sc. '00, M.E.	1901	404 Albert St., Kingston.
Stewart, J. S., B.Sc.	1911	Box 221, Renfrew, Ont.
Stidwell, F., B.Sc.	1908	Cornwall, Ont.
Stiles, L. P., B.Sc.	1907	11508 Detroit St., Cleveland, Ohio.
Stilwell, A. J., B.Sc.	1902	Ellsworth Bldg., Chicago, Ill.
Stirling, J. B., B.A. '09, B.Sc.	1911	Picton, Ont.
Stott, J., B.Sc.	1908	712 Pender St. West, Vancouver, B.C.
Strachan, B. O., B.Sc. '05, M.E.	1907	Box 507, Ely, Minn.
Sutherland, T. F., B.Sc.	1904	Cobalt, Ont.
Sutherland, E., B.Sc. '02, M.D.		Cardinal, Ont.
Sweezy, R. O., B.Sc.	1908	Quebec, Que.
Tett, B., B.Sc.	1904	Newboro, Ont.
Thomas, A. S., B.Sc.	1911	Topographical Survey, Ottawa.
Thompson, A. T., B.Sc.	1904	162 King St., Kingston.
Thornton, L. A., B.A., B.Sc.	1906	City Commissioner, Regina, Sask.
Timm, W. B., B.Sc.	1906	Cordova Mines, Ont.
Tower, W. O., B.Sc.	1912	Belleville, Ont.
Tremblay, J. A., B.Sc.	1911	City Hall, Quebec, Que.
Trueman, J. D., B.A., B.Sc., M.Sc.		
Ph.D.		(Deceased).
Tuckett, W. H., B.Sc.	1911	Bath, Ont.
Turner, N. L., M.A.	1907	Mines Branch, Ottawa, Ont.
Twitchell, K. S., B.Sc.	1908	618 Central Bldg., Los Angeles Cal.

Name.	Date of Graduation.	Address.
†Uglow, W. L., M.A. '06, B.Sc.....	1911..164	Barrie St., Kingston.
Waldner, E. F., B.Sc.....	1912..	Eureka, California.
Walker, H. J., B.A. '02, B.Sc.....	1904..	Cornwall, Ont.
Walker, T. L., M.A. '90, Ph.D.....	..	Professor of Mineralogy, Toronto University, Toronto.
†Wardle, J. M., B.Sc.....	1912..	Hope, B.C.
Warren, H., C.E.....	1912..	Murray Bay, Que.
Watson, R. R., B.Sc.....	1912..	Cornwall, Ont.
Watts, E. E., B.Sc.....	1912..	Moose Creek, Ont.
Way, W. C., B.Sc. '05, M.Sc.....	1906..	Lindsay, Ont.
Webster, A. R., B.Sc.	1904..	Cobalt, Ont.
Wells, J. W., B.Sc.	1898..	192 Shuter St., Toronto.
White, H. T., B.Sc.	1909..	Sudbury, Ont.
Wilgar, W. P., B.Sc.	1903..	Care N. T. Ry., Nepigon, Ont.
Williams, K. F., B.A. '09, B.Sc.....	1910..	150 University Ave., Kingston.
Williams, M. Y., B.Sc. '09; Ph.D.....	1912..	"The Maples," R.R. No. 1, Picton, Ont.
Williams, T. B., B.Sc.	1909..	"The Maples," R.R. No. 1, Picton, Ont.
Wilson, E. E. D., B.Sc.....	1911..	Topographical Surveys Branch, Ottawa, Canada.
Woods, S. A., B.Sc.....	1909..	Canadian Westinghouse, Hamilton, Ont.
Woolsey, W. J., B.Sc.....	1907..	Thetford Mines, Que.
Workman, C. W., B.Sc.....	1903..	121 Alfred St., Kingston, Ont.
Workman, J. K., B.Sc.	1904..	Copper Cliff, Ont.
Wright, A., B.Sc.	1905..	Welland, Ont.
Wright, G. C., B.Sc.	1907..	Member of firm, Campbell & Wright, Kingston, Ont.
Wright, L. E., B.Sc.	1911..	Conway, Ont.
Young, A. C., B.Sc.	1910..	Renfrew, Ont.
Young, J. H., B.Sc.....	1910..	Almonte, Ont.

LIST OF STUDENTS.

Session 1912-'13.

FIRST YEAR.

Name.	Address.
Barrett, G.	Williamstown.
Barthe, M.	Montcalmville, Que.
Bates, C. W.	Ottawa.
Birkett, L. H.	Kingston.
Bragg, E. K.	London.
Brinkman, F. L.	St. Thomas.
Butcher, C. W.	Havelock.
Calder, L. R.	Nanaimo, B.C.
Campbell, E. E.	Vernon.
Carnochan, R. K.	Ottawa.
Cheney, H. W.	Ottawa.
Cliff, G. H.	Bath Road, P.O.
Cline, A. H.	Zelma, Sask.
Cole, W. S.	Brockville.
Collins, W. H.	Toronto.
Connell, W. H.	Spencerville.
Dafoe, E. R.	Banff, Alta.
Dagenais, J. H.	Morewood, Ont.
Darby, A. T.	Hamilton, Ont.
Daryaw, C.	Kingston, Ont.
Davidson, R. F.	Toronto, Ont.
Denyes, W. B.	Morven, Ont.
Donevan, F. J.	Melcombe, Ont.
Drewry, S.	Smithfield, Ont.
Ellis, F. J.	Ellwood, Ont.
Fallis, L. S.	Millbrook, Ont.
Farrell, Jas. W.	Moosomin, Sask.
Farnsworth, R. H.	Coaticook, Que.
Fawcett, R. M.	Sackville, N.B.
Finnemore, H. F.	Paris, Ont.
Fraser, C.	Brockville, Ont.
Fraser, F.	Almonte, Ont.
Fraser, O.	Brockville, Ont.
Free, H.	Campbellford, Ont.
Gauthier, H. A.	Alexandria, Ont.
Godson, F. P.	Fenbury, Worcestshire, Eng.
Hamilton, R. E.	Toronto, Ont.
Harper, J. C.	Port Townsend, Wash.
Harrison, S. J.	Kingston, Ont.
Haryett, H. C.	Fort Stewart, Ont.

Name.	Address.
Hemmerick, G.	Conestago, Ont.
Hurlburt, H. W.	Mitchell, Ont.
Irwin, B. L.	Cornwall, Ont.
Jackson, A.	Hamilton, Ont.
Johnston, G. G.	Kingston, Ont.
Keeley, E. C.	Railton, Ont.
Kennedy, S.	Apple Hill, Ont.
Lawrence, C. V.	Ottawa, Ont.
Loughrin, T. D.	Mattawa, Ont.
Mabee, H. C.	Picton, Ont.
Mallory, G. D.	Mallorytown, Ont.
Martin, J. S.	Hamilton, Ont.
Martin, W. W.	Regina, Sask.
Miller, W. C.	St. Thomas, Ont.
Minnes, H. S.	Kingston, Ont.
Morgan, S. C.	Elgin, Ont.
Murray, K. I.	St. Stephen, N.B.
McCallum, A. N.	Sunbury, Ont.
MacCallum, F. L.	Kingston, Ont.
McIntosh, A. K.	Cold Springs, Ont.
McLatchie, G. F.	Ottawa, Ont.
McLennan, M. T.	Russell, Man.
McLennan, R. C.	Russell, Man.
Nicholson, F. A.	St. Stephen, N.B.
Nicholson, M. D.	Goderich, Ont.
Nicholson, V.	Kingston, Ont.
O'Connor, G. D.	Bridgeburg, Ont.
Orr, W. S.	Cobourg, Ont.
Palsen, G.	Reykjavick, Iceland.
Parrott, J. R.	Odessa, Ont.
Payne, T. H. L.	Kingston, Ont.
Peterson, A. H.	Cobourg, Ont.
Poon, Y. D.	Toronto, Ont.
Poynton, C. A.	Toronto, Ont.
Pringle, F. D.	Hamilton, Ont.
Quartz, E. D.	Cane, Ont.
Ramsay, D. G.	Ottawa, Ont.
Ringsleben, W. C.	Renfrew, Ont.
Roach, L. J.	Sault Ste. Marie, Ont.
Robb, E. R.	Almonte, Ont.
Rogers, A. B.	Gananoque, Ont.
Shaw, W. A.	Carleton Place, Ont.
Slinn, Wm. H.	Billings Bridge, Ont.
Sloan, J. H.	Toronto, Ont.

Name.	Address.
Smith, G.	Kingston, Ont.
Smith, L. J.	Westboro, Ont.
Smith, O.	Lindsay, Ont.
Smith, R. F.	Trenton, Ont.
Spears, D. C.	Toronto, Ont.
Spring, J. H.	Kingston, Ont.
Stewart, J. R.	City View, Ont.
Stewart, N. G. (B.A.)	Renfrew, Ont.
Stewart, Wm. J.	Renfrew, Ont.
Taft, V. L.	Picton, Ont.
Turner, S. R.	Peterboro, Ont.
Welsh, R. L.	Guelph, Ont
West, G. D.	Avonmore, Ont.
Wilkins, C. V.	Trenton, Ont.
Wilson, E. V.	Kingston, Ont.
Wilson, H. S.	Regina, Sask.
Wood, N. C.	Kamloops, B.C.
Woodside, H. A.	Port Arthur, Ont
Wright, H. C.	Sandhurst, Ont.

SECOND YEAR.

Name.	Address.	Course.
Anderson, Geo. B.	Morrisburg	Mining.
Audet, P.	Quebec, Que.	Civil.
Baker, E. A.	Millhaven	Electrical.
Bick, A. H.	Ottawa	Civil.
Bonham, J. C.	Jerseyville	Civil.
Braun, E. F.	New York, N.Y.	Mining.
Browne, D. G.	Copper Cliff	Civil.
Burchell, F. C.	Sydney, N.S.	Civil.
Charters, D. E.	Hawley	Electrical.
Connerty, A. C.	Jasper	Civil.
Danais, P.	Eaie St. Paul, Que.	Civil.
Dunsmore, R. L.	St. Thomas	Civil.
Earnshaw, P.	Almonte	Civil.
Ferris, C. B.	Toronto	Civil.
Fournier, J. A.	Sudbury	Mining.
Franklin, B. W.	Joyceville	Civil.
Garvie, R. A.	Jackson	Civil.
Guthrie, W. M.	Perth Road	Mining.
Hepinstall, John	St. Thomas	Civil.
Hughson, T. L.	St. Xia Falls, Ont.	Civil.
Johnston, W. J.	Carmel, Sask.	Electrical.
Kerr, H. O.	Montreal, Que.	Mining.

Name.	Address.	Course.
Laird, J. S.	Essex	Civil.
Laturney, Fred.	Kingston	Civil.
Livingstone, E. L. D....	Douglas	Mining.
Lynch, L.	Chesterville	Civil.
Manchester, D. E.....	Ottawa	Mechanical.
Martineau, J. O.	Quebec, Que.	Civil.
McCarthy, F. W.....	Kingston	Civil.
McCartney, N.	Sydenham	Civil.
McDermott, M.	Kingston	Electrical.
Nixon, N. J.	Smith's Falls	Electrical.
Patterson, G. B.....	London	Electrical.
Pettingill, E. L.....	Wellington	Civil.
Platt, B. C.	Saskatoon, Sask.	Electrical.
Prouse, S. E.....	Aylmer	Civil.
Putman, C. V.	Ottawa	Civil.
Racknor, E.	Saskatoon, Sask.	Civil.
Reid, G. J.	Kingston	Mechanical.
Roberts, G. I.....	Westwood, N.J.	Mining.
Robinson, E. K.....	Kingston	Civil.
Rogers, C. R.....	Oakwood	Civil.
Ross, J. C.	Grandview, Man.	Mining.
Schofield, C. A.....	Kingston	Analytical.
Sherk, H. C.	Sherkston	Chem. and Mineralogy.
Shiels, M. S.....	Copper Cliff	Civil.
Sheriff, C. F.....	Brockville	Civil.
Smith, G. J.....	Kingston	Civil.
Smith, L. G.....	Haileybury	Mining.
Smith, R. T.....	Sudbury	Mechanical.
Van Patter, H. S.....	Aylmer	Civil.
Walton, C. G.....	Brockville	Civil.

THIRD YEAR.

Name.	Address.	Course.
Ahern, F. X.	Quebec, Que.	Civil.
Aird, J. K. W.	Toronto.	Mechanical.
Allan, F. M.....	Vancouver, B.C.	Civil.
Baker, H. S.....	Napanee, Ont.	Mining.
Ball, A. N.	Grenfell, Sask.	Civil.
Bell, E. P.....	Cobourg, Ont.	Mechanical.
Bews, D. W.	Gananoque	Civil.
Bird, F. G.	Westboro	Civil.
Bolton, A.	Strathroy, Ont.	Electrical.
Boughner, J. W.....	St. Thomas, Ont.	Civil.

Name.	Address.	Course.
Brebner, K. A.	Kingston	Mechanical.
Browne, E. F.	Ottawa	Civil.
Buchanan, W. C.	Kingston	Civil.
Bunker, N.	Toronto	Civil.
Burnham, D. W.	Cobourg	Electrical.
Burns, S. L.	Kingston	Mechanical.
Buskard, C. H.	Belleville	Mining.
Calvin, R. M.	Garden Island	Civil.
Cameron, J. G.	Cornwall	Civil.
Carmichael, A. D.	Mair's Mills	Chemical.
Cook, W. S.	Ottawa	Civil.
Craig, H. C.	Cobourg, Ont.	Mining.
Dallyn, H. H.	St. Thomas, Ont.	Electrical.
Daly, F. G.	Lloydminster, Sask.	Electrical.
Davidson, R. E.	Cobourg, Ont.	Electrical.
Denovan, R. A.	Dalkeith, Ont.	Mechanical.
Gerow, S.	Rossmore, Ont.	Civil.
Harris, H.	St. Catharines, Ont.	Mining.
Hepinstall, R. R.	Fort William, Ont.	Civil.
Latimer, S.	Brodie, Ont.	Chemical.
Lawson, W. G.	Dundas, Ont.	Electrical.
Martin, E. A.	Sudbury, Ont.	Electrical.
Matthews, H. E.	Trenton, Ont.	Mining.
Millen, W. A.	Sandwich, Ont.	Electrical.
Miller, W. H.	Regina, Sask.	Civil.
McCannel, D. A. R.	Regina, Sask.	Civil.
Macdonald, J. O.	Strathroy, Ont.	Mining.
McIlquham, W. R.	Carleton Place, Ont.	Mining.
McKenzie, R. W.	Clinton, Ont.	Chemical.
McNally, H. A.	Westport, Ont.	Civil.
Macpherson, K. P.	Prescott, Ont.	Electrical.
MacRae, A. E.	Weyburn, Sask.	Chemical.
McVittie, A. E.	Sudbury, Ont.	Electrical.
McVittie, J. S.	Sudbury, Ont.	Electrical.
Noonan, W. F.	Kingston	Civil.
Nourse, H. C.	Sherbrooke, Que.	Mechanical.
Patterson, R. P.	Newburgh, Ont.	Mining.
Patton, J. H.	Ottawa	Civil.
Pearse, W. G.	London, Ont.	Civil.
Raitt, G. H.	Ottawa	Mechanical.
Rutledge, P. R.	Dunrobin, Ont.	Electrical.
Scott, H. L.	Bridgebury	Mining.
Sharman, H. J.	Kingston	Electrical.
Sherrill, J. R.	Athol Springs, N.Y.	Mining.

Name.	Address.	Course.
Smail, F. H.	Regina, Sask.	Civil.
Smith, R. M.	Kingston	Civil.
Smith, W. N.	Sudbury, Ont.	Mining.
Stinson, J. N.....	Toledo, Ont.	Civil.
Whyte, J. S.....	St. Thomas, Ont.	Electrical.
Wilkins, C. H.....	Hastings, Ont.	Civil.
Wilson, D. M.....	Regina, Sask.	Civil.
Wood, F. M.....	Kingston	Civil.

FOURTH YEAR.

Name.	Address.	Course.
Adam, L. R.	Quebec, Que.	Civil.
Anderson, A. K.....	Ottawa, Ont.	Mining.
Aykroyd, M. J.....	Edmonton, Alta.	Civil.
Bell, J. W.....	Port Credit, Ont.....	Mining.
Benger, F.	Port Arthur, Ont.....	Mechanical.
Brown, R. W.....	Kingston, Ont.	Electrical.
Burdekin, R. W.....	Gouverneur, N.Y.	Electrical.
Cantello R, C.	St. Thomas, Ont.....	Chemical.
Caughy, J. E.....	Calgary, Alta.	Civil.
Cram, R. M.....	Westboro, Ont.	Civil.
Cross, J. G.....	Port Arthur, Ont.....	Mining.
Dalziel, W.	Georgetown, P.E.I.	Mechanical.
Dawson, S. G.....	Ottawa, Ont.	Civil.
Dawson, W. L.....	Vancouver, B.C.	Electrical.
Dick, H. S.....	Kingston, Ont.	Civil.
Doyle, C. J.....	Kingston, Ont.	Mechanical.
Dunlop, H. J.	Ottawa, Ont.	Civil.
Eaton, H. T.....	Carlisle, Ont.	Civil.
Elliott, E. F.....	Kingston, Ont.	Mining.
Erskine, J. A.....	Hamilton, Ont.	Civil.
Freeman, C. H.....	Kingston, Ont.	Mining.
Harkness, H. W.	Cornwall, Ont.	Mechanical.
Harkness, R. D.....	Cornwall, Ont.	Electrical.
Harvey, J. P.....	Vermillion, Alta.	Civil.
Hinton, R. E.	Gananoque, Ont.	Electrical.
Ireland, S. K.....	Stratford, Ont.	Civil.
Jemmett, D. M.....	Napanee, Ont.	Electrical.
Johnston, W. M.	Stanford, Ont.	Civil.
Kane, W. L.	Kingston, Ont.	Civil.
Kirkegaard, C. A.....	Toronto, Ont.	Mining.
LaForest, M.	Montreal, Que.	Civil.
Laidlaw, C. O.....	Edmonton, Alta.	Civil.

Name.	Address.	Course.
Laidlaw, C. T.....	Kingsville, Ont.	Civil.
Laing, W. S.....	Peterboro, Ont.	Mechanical.
Lumb, W. E.....	Port Stewart	Civil.
Madden, M. S.	Napanee, Ont.	Civil.
Manhard, W. E.....	Port Arthur, Ont.	Civil.
Marshall, J. R.....	Ottawa, Ont.	Mineralogy.
Matheson, H.	Eburne, B.C.	Electrical.
Meek, R. L.....	Kingston, Ont.	Mechanical.
Melrose, T. M.....	Coaticooke, Que.	Civil.
McAuliff, F. P.....	Welland, Ont.	Civil.
McCann, W. S.....	Kingston, Ont.	Mining.
McDougall, B. W. W....	Lancaster, Ont.	Mining.
MacKenzie, C. S.....	Portage la Prairie, Man.	Civil.
McKenzie, R. W.....	Clinton, Ont.	Chemical.
MacLeod, G. W.....	Sherbrooke, Que.	Mining.
McNeice, L. G.....	Reay, Ont.	Civil.
Parsons, C. S.	Middleton, N.S.	Mining.
Pound, J. F.....	Kingston, Ont.	Mechanical.
Rogers, H. D.....	Gananoque, Ont.	Civil.
Sirett, E. J.	Rosseau, Ont.	Civil.
Sterne, E. T.	Brantford, Ont.	Anal. Chemistry.
Warren, H.....	Murray Bay, Ont.	Civil.
Wigle, E. R.....	Kingsville, Cnt.	Mining.
Wilson, E. E.....	Hamilton, Ont.	Civil.
Wilson, R. R.....	Fernie, B.C.	Mining.

TIME TABLE.
SECOND YEAR.

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
MON.	Physics II. A.E.F.G. Min. II (a) B.C.	Draw. II A. (1) Phys. III B.D.F.G. Biology C. Sur. II E.	Math. II.	Min. III (b) A.C. Gen. Eng. I D.E.F.G.	Draw. II. A. (1) Workshop I A. (2) Anal. Ch. II B.C.D. Sur. III E	Draw. II A. (1) Workshop I A. (2) Anal. Ch. II B.C.D. Sur. III E.	Desc. Geom. A. Workshop I A. (2) Org. Ch. I D. Sur. III E. Phys. II F.G.	Desc. Geom. A. German B.C. Org. Ch. I D. Phys. II. F.G.
TUES.	Math. III.	Geol. I A.B.C.E. Anal. Ch. I D.	Math. II.	Min. I A.B.C.D. Anal. Ch. I E.F.G.	Anal. Ch. IV B.C. Anal. Ch. I D.E.F.G.	Workshop I A. (1) Drawing II A. (2) Anal. Ch. IV B.C. Anal. Ch. I D.E.F.G.	Workshop I A. (1) Drawing II A. (2) Phys. III B.D.F.G. Phys. II E.	Workshop I A. (1) Draw. II A. (2) Phys. III B.D.F.G. Phys. II E.
WED.	Physics II A.E.F.G. Anal. Ch. IV D. Min. II (a) B.C.	Anal. Ch. III A.B.C. Desc. Geom. E.D. Anal. Ch. IV D. Mech. Eng. VII F.G.	Anal. Ch. III A.B.C. Desc. Geom. E.D. Mech. Eng. VII F.G.	Anal. Ch. III A.B.C. Desc. Geom. D. Min. V (a) E. Mech. Eng. VII F.G.	Math. III.	Sur. VI A.C. German B. Draw. II D. E. (2) Workshop I E. (1)	Sur. VI A. C. Org. Ch. I B. Draw. II D. E. (2) Workshop I E. (1)	Sur. VI A. C. Org. Ch. I B. Draw. II D. E. (2) Workshop I E. (1)

SECOND YEAR.—(Continued)

	VIII	IX.	X.	XI.	I.	II.	III.	IV.
THURS.	Gen. Ch. II A,B,C,D. Sur. II. E.	Sur. VI A.C. German B. Gen. Eng. I D,E,F,G.	Math. II	Min. III (b) A.C. Org. Ch. I B.D.	Desc. Geom. A,C,D,E,F,G.	Geol. I A,B,C,E. Anal. Ch. IV D.		
FRIDAY	Math. III	Min. II (a) B.C. Draw. III. F.G.	Min. I A,B,C,D. Draw. III F.G.	Min. I A,B,C,D. Draw. III F.G.	Anal. Ch. I A,B,C. Anal. Ch. III D. Sur. II E.	Anal. Ch. I A,B,C. Anal. Ch. III D. Sur. II E. Desc. Geom. F.G.	Anal. Ch. I A,B,C. Anal. Ch. III D. Sur. II E. Desc. Geom. F.G.	Engineering Society
SAT.	Min. Geol. Excursions	Anal. Ch. IV B,C,D. Phys. II A. Draw. II E (1) Workshop I E (2) Draw. III F.G.	Anal. Ch. IV B,C,D. Phys. II A. Draw. II E (1) Workshop I E (2) Draw. III F.G.	Anal. Ch. IV B,C,D. Phys. II A. Draw. II E (1) Workshop I E (2) Draw. III F.G.				

TIME TABLE
THIRD YEAR.

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
MON.	Ore Dressing A.C.D.	Elec. Eng. A.D.E.F.I Phys. Ch. III Anal. Ch. V C.	Geol. IV (a) A.C. Phys. Ch. III B. Geol. II (b) C. Phys. Ch. I D. Str. Eng. I E.F. Phys. IV G.	Gen. Eng. I A. Min. III (b) B. Phys. Ch. I E.C.D. Mech. Eng. IV F. Elec. Eng. II G.	Phys. Ch. I B.C.D. Gen. Eng. II D.E.F.G. Geol. III Lab. A.		Gen. Eng. III A. Ind. Ch. I B.D. Anal. Ch. V C. Anal. Ch. VII E. Mech. Eng. III F. Phys. IV G. Geol. III Lab. A.	Gen. Eng. III A. Org. Ch. II B. German C. Anal. Ch. VII E. Mech. Eng. III F. Phys. IV G. Geol. III Lab. A.
		Elec. Eng. III G.			Geol. III Lab. A.	Min. IV A.B.C. Sur. V Ind. Ch. II E. F. Mech. Eng. III D. Elec. Eng. III G.	Anal. Ch. VI B.C. Sur. V E. Mech. Eng. III F.D. Elec. Eng. IV G. Geol. III Lab. A.	Anal. Ch. VI B.C. Anal. Ch. VII E. Mech. Eng. III F.D. Elec. Eng. IV G. Geol. III Lab. A.
	Min. IV A.B.C.	Mining I (b) A.C. Thermo I (a) A.D.E.F.G. Thermo II (b) D.E.F.G.	Geol. III A.C. Hyd. Eng. I E.F.	Met. I A.B.D.E.F.G.	Min. IV A.B.C. Sur. V Ind. Ch. II E. F. Mech. Eng. III D. Elec. Eng. III G.	Min. IV A.B.C. Sur. V E. Mech. Eng. III F.D. Elec. Eng. III G.	Anal. Ch. VI B.C. Sur. V E. Mech. Eng. III F.D. Elec. Eng. IV G. Geol. III Lab. A.	Anal. Ch. VI B.C. Anal. Ch. VII E. Mech. Eng. III F.D. Elec. Eng. IV G. Geol. III Lab. A.
TUES.								
WED.	Met. I A.B.D.E.F.G.	Mech. Eng. VIII A.D.E. Elec. Eng. II G.	Geol. II (a) A.C. Geol. V (b) A.C. Gen. Eng. II D.E.F.G.	Mining I A.C. Min. III (b) B. Gen. Eng. VI E. Mech. Eng. I (a) II (b) D (a) F.G.	Min. IV A.B.C. Mech. Eng. I (a) II (b) D (a) F.G. Sur. IV. E.	Anal. Ch. IV A. Org. Ch. II B. Anal. Chem. V. C. Sur. IV E. Workshop I D. Thermo V. F. Phys. IV G.	Anal. Ch. IV A. Org. Ch. II B. Ry. Eng. I E. Workshop I D. Thermo V. F. Phys. IV G.	Org. Ch. II B. Ry. Eng. I E. Workshop I D. Thermo V. F. Phys. IV. G.

THIRD YEAR.—(Continued.)

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
THUR.	Min. VI C. Anal. Ch. V D.	Gen. Eng. I A. German C. Anal. Ch. V D. Ry. Eng. I E. Elec. Eng. II G.	Geol. III A.C. Anal. Ch. V D. Hyd. Eng. I E.F.	Ore Dressing A.C.D. Min. III (b) B. Mech. Eng. IV F. Elec. Eng. II G.	Surv. VII A. Anal. Ch. V B.C. Gen. Eng. III D.E.F.G.	Surv. VII A. Anal. Ch. V B.C. Gen. Eng. III D.E.F.G.		
FRIDAY.	Mining I A.C. (a) Phys. Ch. I B.C.D.	Thermo I (a) A.D.E.F.G. Elec. Eng. I (b) A.D.E.F. Anal. Ch. VI B.C. Elec. Eng. III (b) G.	Geol. IV (a) A.C. Geol. II (b) C Anal. Ch. VI B. Mech. Eng. I (a) II (b) D. (a) F. G. Ry. Eng. I E.	Sur. VII A. Anal. Ch. VI B.C. Mech. Eng. I (a) II (b) D. (a) F. G. Sur. IV E.	Anal. Ch. IV A. Anal. Ch. V B.D. Anal. Ch. VI C. Str. Eng. I E.F. Elec. Eng. IV G.	Anal. Ch. IV A. Anal. Ch. V B.D. Str. Eng. I E.F. Elec. Eng. IV G.	Anal. Ch. IV A. Anal. Ch. V B. Str. Eng. I E.F. Elec. Eng. IV G.	
SAT.	Fire Assay (b) A.C. Ind. Ch. I B.D. Eng. Fld. Wk II (a) E.	Fire Assay (b) A.C. Ind. Ch. I B.D. Eng Fld Wk. II (a) E. Gen. Eng. VI (b) E. Mech. Eng. III F. Elec. Eng. II G.	Fire Assay (b) A.C. Ind. Ch. I B.D. Eng. Fld Wk. II (a) E. Gen. Eng. VI (b) E. Mech. Eng. III F. Elec. Eng. II G.	Fire Assay (b) A.C. Ind. Ch. I B.D. Eng. Fld Wk. II (a) E. Gen. Eng. VI (b) E. Mech. Eng. III F. Elec. Eng. II G.				

TIME TABLE.
FOURTH YEAR.

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
MON.		Met. II A.C.D.	Mining II Org. Ch. V B	Mech. Eng. IV A.D.E.G.	Gen. Ch. III B.D. Elec. Eng. XI (b) G.	Gen. Eng. II A. Gen. Ch. III B.D. Hyd. Eng. II E.	Geol. VIII A.C. Org. Ch. V B. Str. Eng. II E.	Org. Ch. V B.
	Gen. Ch. III B.D.	Ry. Eng. III E. Mech. Eng. VI F.	Struct. Eng. I D. Ry. Eng. II E.	Org. Ch. V B.	Mech. Eng. IX F. Mech Eng VIII (a) G.	Mech. Eng. IX F. Mech Eng VIII (a) G. Elec. Eng. VIII (b) G.	Mech. Eng. IX F. Mech Eng VIII (a) G. Elec. Eng. VIII (b) G.	Economics
		Elec. Eng. opt (b) G.	Elec. Eng. VII G. Elec. Eng. VII F.	Elec. Eng. VII F.				
TUES.	Org. Chem. V B.	Org Ch. V B. Met. II A.C.D.	Org. Ch. V B. Hyd. Eng. I A.G. Ch. Eng. I D. Mun. Eng. II E.	Org. Ch. III B. Geol. VIII A.C. Ch. Eng. II D. Hyd. Eng. III E. Thermo III F.G.	Ind. Ch. II A.F. Ch. Eng. II D. Mech. Eng. V F.	Min. & Met. IV A. Phys. Ch. II B.D. Str. Eng. III E. Mech. Eng. V F. Elec. Eng. V G.	Min. & Met. IV A. Phys. Ch. II B.D. Str. Eng. III E. Mech. Eng. V F. Elec. Eng. V G.	Phys. Ch. II B.D. Str. Eng. III F. Mech. Eng. V F. Elec. Eng. V G.
WED.	Org. Ch. V B.	Org. Ch. V B. Mining II A.	Gen. Eng. II A. Phys. Ch. II B.D. Mun. Eng. III E. Mech. Eng. IX F. Elec. Eng. V G.	Met. II A.C.D. Ry. Eng. III E. Elec. Eng. VI G.	Min. & Met. IV A. Org. Ch. IV B. Str. Eng. I D. Surf. IV E. Mech. Eng. V F.	Min. & Met. IV A. Org. Ch. IV B. Anal. Ch. VI D. Surv. IV E. Mech. Eng. V F. Elec. Eng. VI G. (b)	Min. & Met. IV A. Org. Ch. IV B. Anal. Ch. VI D. Gen. Eng. IV E. Mech. Eng. V F. Elec. Eng. VI G. (b)	Org. Ch. IV B. Anal. Ch. VI D. Gen. Eng. IV E. Mech. Eng. V F. Elec. Eng. VI G. (b)
	Str. Eng. III E.							

FOURTH YEAR.—Continued.

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
THUR.	Min. VI A, B. Ch. Eng. II D.	Met. II A, C, D. Org. Ch. V B. Geol. IX (a) E. Thermo III F, G.	Bacteriology B. Hyd. Eng. I A, G. Ch. Eng. I D. Mun. Eng. I (a) (b) E. Mech. Eng. IX F.	Bacteriology B. Mech. Eng. IV A, D, E, G. Geol. VI C. Mech. Eng. IX F.	Or. Ch. V B. Ch. Eng. II D. Ry. Eng. II, III E. Mech. Eng. IX F.	Mining II A. Org. Ch. V B. Ch. Eng. II D. Ry. Eng. II, III E. Mech. Eng. IX F. Met. III (b) G.		
FRIDAY.	Milling A, Ch. VIII B.	Milling A. Anal. Ch. VIII E.	Milling A. Anal. Ch. VIII B.	Milling A. Anal. Ch. VIII B. Geol. VII C. Ch. Eng. II D. Eng. Fld. Wk. III E. Thermo IV F. Elec. Eng. IX (a) G.	Milling A. Str. Eng. I D. Str. Eng. II E. Thermo IV F. Elec. Eng. opt G.	Milling A. Org. Ch. III B. Str. Eng. I D. Str. Eng. II E. Thermo IV F. Elec. Eng. opt. G.	Milling A. Org. Ch. III B. Str. Eng. I D. Str. Eng. E. Thermo IV F. Elec. Eng. VI (a) V (b) G.	Engineer's Society
SAT.	Milling A. Ch. Eng. II (a) D. Fire Assay (b) B, D. Thermo III (a) F, G. Mech. Eng. VIII F, G.	Milling A. Ch. Eng. II (a) D. Fire Assay (b) B, D. Mun. Eng. E. Thermo III (a) F, G. Mech. Eng. VIII (b) F, G.	Milling A. Ch. Eng. II (a) D. Fire Assay (b) B, D. Mun. Eng. E. Thermo III (a) F, G. Mech. Eng. VIII (b) F, G.	Milling A. Ch. Eng. II (a) D. Fire Assay (b) B, D. Mun. Eng. E. Thermo III (a) F, G. Mech. Eng. VIII (b) F, G.				

